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POSITIVE MINDFULNESS FOR PEOPLE EXPERIENCING CHRONIC PAIN

Section A: The impact of mindfulness training on subjective wellbeing in people with chronic pain: a review
Word count: 7990 (28)

Section B: Improving subjective wellbeing in people experiencing chronic pain using a Mindfulness-Based Flourishing program: a randomised controlled trial
Word Count: 7466 (136)

Overall Word Count: 15,456 (164)

A thesis submitted in partial fulfilment of the requirements of
Canterbury Christ Church University for the degree of
Doctor of Clinical Psychology

AUGUST 2018

SALOMONS
CANTERBURY CHRIST CHURCH UNIVERSITY

Acknowledgements

Thank you to everyone who participated in the research project for kindly giving their time. Thank you to Tony for his cool-headed and wise support throughout the project, and for his confidence in me. Thank you to Itai for setting me up with the project and helping me with technical queries as well as academic ones. Thank you to Sabina for her very enthusiastic statistics support! Thank you to the staff at INPUT and the Pain Management Centre for their help with promoting the project, especially to Beth, Amy and Tim.

Summary of the MRP portfolio

Section A presents a literature review of research investigating the effects of mindfulness-based interventions (MBIs) on subjective wellbeing among adults with chronic pain. Fourteen quantitative intervention studies and three qualitative studies are reviewed. The findings of these studies are synthesised, using a theoretical structure of subjective wellbeing comprising life satisfaction, hedonic wellbeing and eudaimonic wellbeing, to overcome the heterogeneity in measures of wellbeing. Clinical and research implications are considered, including the suggestion for research into interventions that combine positive psychology and mindfulness.

Section B presents a randomised controlled trial of an online Mindfulness-Based Flourishing program (MBF). Fifty-seven adults who experienced chronic pain were randomly assigned to either the MBF or to a waitlist control condition. The complete-case approach taken to data analysis included the thirty participants who completed measures at all three time points (baseline, post-intervention and follow-up). Although the study was underpowered, recipients of the MBF benefitted from significantly improved subjective wellbeing, mindfulness, health quality of life and reduced pain catastrophising by follow-up. The results are considered in the light of other research and theory and suggestions are made for further research.

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SECTION A: LITERATURE REVIEW

The impact of mindfulness training on subjective wellbeing in people with chronic pain: a review

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April 2018

Word Count: 7990 (28)

A thesis submitted in partial fulfilment of the requirements of Canterbury Christ Church University for the degree of Doctor of Clinical Psychology

Abstract

Aim: Chronic pain is a common complaint that impacts negatively on subjective wellbeing. This article reviews the contribution of research to the question of whether mindfulness interventions improve subjective wellbeing in people experiencing chronic pain.

Method: A systematic literature search was undertaken using MEDLINE, PsycINFO, ASSIA and references from retrieved articles. Qualitative and quantitative studies evaluating the effects of mindfulness-based interventions (MBIs) on participants' hedonic and eudaimonic wellbeing were included.

Results: Fourteen quantitative intervention studies and three qualitative studies were retrieved. Overall, MBIs had positive effects on measures of hedonic wellbeing. Tentative evidence was found for improvements to eudaimonic wellbeing and life evaluation. The qualitative literature indicated that, during and after participation in MBIs, people with chronic pain benefited from enhanced positive emotion, increased sense of purpose, meaning and better social and psychological functioning.

Discussion: There appears to be promise for MBIs as a method for improving subjective wellbeing in chronic pain populations. However, the measures of wellbeing used were heterogeneous and often limited, and samples lacked diversity.

Conclusions: Improved methodological rigour and more consistent definition and measurement of wellbeing are needed in future research.

Keywords: Chronic pain; mindfulness; wellbeing; eudaimonic; hedonic.

Introduction

Chronic pain

Chronic pain is defined as "persistent or recurrent pain lasting longer than three months" (Treede et al., 2015), beyond normal healing time. It may be primary (where aetiology is unknown) or secondary to a condition or previous trauma. Chronic pain is a common complaint among adults, with adult prevalence estimated at 43.5% in the UK (Fayaz, Croft, Langford, Donaldson & Jones, 2016). The National Pain Audit (Price, 2012) reports that severe chronic pain negatively affects all aspects of a person's health and impacts heavily on quality of life; for example on sleep, relationships, employment, and mood.

Interventions for chronic pain

Despite a range of pharmaceutical, surgical and medical interventions that seek to remove pain, nothing so far has been found to be fully effective at reducing pain, nor at substantially improving pain-related disability. Medical options for treating chronic pain, such as drugs and surgery, are effective only for a subset of people, and even among those only manage to reduce pain by 30-40% (Turk, Wilson, & Cahana, 2011). This is perhaps unsurprising, given modern biopsychosical understandings of pain as a "personal, subjective experience influenced by cultural learning, the meaning of the situation, attention, and other psychological variables" (Melzack & Katz, 2001, p.35).

Given widespread recognition that psychosocial factors play an important role in the experience of chronic pain (Turk & Okifuji, 2002), combined psychological and physical approaches are recommended for pain management when pharmacological

or physical treatments do not lead to satisfactory improvement, for example in low back pain (NICE, 2016). Cognitive behavioural therapies (CBT) currently dominate the evidence base for psychological treatments, but, like medical treatments, the effect sizes are modest (McCracken & Morley, 2014).

Mindfulness and acceptance and commitment therapies (ACT) are also used, based on a theoretical assumption that increased mindfulness and psychological flexibility will lead to reduced pain, distress and disability through non-judgemental observation of, and adaptive responses to, pain and stress (McCracken & Morley, 2014). The widely taught mindfulness based stress reduction (MBSR) program was originally designed to help people with chronic pain (Kabat-Zinn, 1982). Reviews of acceptance- and mindfulness-based interventions (MBIs) for chronic pain have found small effects on pain, but larger effects on pain interference and emotional outcomes that, unlike pain intensity, increased at follow-up (Veehof, Trompetter, Bohlmeijer and Schreurs, 2016; Veehof, Oskam, Karlein, Schreurs & Bohlmeijer, 2011). These findings suggest psychological interventions may be best focused on living well despite pain rather than reducing pain itself.

Wellbeing in chronic pain

Whilst reduction of pain, distress and disability must of course remain important goals contributing to quality of life, Rusk and Waters (2013) argue that the removal of disease or distress does not automatically create wellbeing. Indeed, the World Health Organisation (WHO, 2014) defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Research in the field of positive psychology has studied the subjective psychosocial aspects of this

state of wellbeing, referred to by Seligman (2011) as "flourishing" and Keyes (2002) as "mental health". They, and others (see Linton, Dieppe, Medina-Lara, Watson, & Crathorn, 2016), consider subjective wellbeing to consist of positive emotional states (hedonic wellbeing) as well as meaning, social functioning and development of potential (eudaimonic wellbeing).

The benefit of eudaimonic wellbeing in chronic pain

While the experience of chronic pain is strongly associated with lower quality of life, some people are outliers in this correlation. Thompson (2014) identified people who were coping well with chronic pain in order to learn from their approaches to life with pain. She noticed that achieving a state of wellbeing is possible even when pain is present. Her participants were not "overly invested in reduced pain as an outcome" (p.191) when trying out treatments, supporting the idea of shifting the focus away from pain reduction. From her research, Thompson developed a grounded theory proposing that people who cope well with chronic pain decide to turn from patient to person, occupy themselves and develop future plans where possible. These attributes align with the concept of eudaimonic wellbeing, suggesting that pursuing eudaimonia may help people to live well with pain. Consistent with this, Ong, Zautra, and Carrington Reid (2015) advocate a "two-dimensional view of pain patients' emotional well-being, one not defined solely by how much pain and distress they experience, but also by how well they attend to the personal goals and social relations that give meaning and value to their lives" (p.283).

The benefit of hedonic wellbeing in chronic pain

Ong et al. (2015) also stress the importance of positive emotions for people with chronic pain. Drawing on theory and research, they demonstrate that positive

emotions have the potential to reduce the burden of chronic pain, enhance recovery from pain and stress, and contribute to better overall functioning. For example, Davis, Zautra and Smith (2004) found that people who experienced more positive emotion when in pain were less vulnerable to negative emotion and future pain. Lazarus, Kanner, and Folkman (1980) theorised that positive emotions during times of intense stress enable coping and replenish depleted resources, acting like a psychological time-out.

Mindfulness

The role of mindfulness in enhancing wellbeing

Mindfulness, a form of non-judgmental awareness and attention to the present moment (Kabat-Zinn, 2003), is associated with enhanced wellbeing. Thompson (2014) discovered that all 19 of her participants used mindfulness or "non-judgmental awareness of pain", even though only one had been trained in mindfulness. Consistent with Veehof et al's (2016) findings, this suggests that mindfulness could help people to experience wellbeing despite pain. Brown and Ryan (2003) found that people's levels of mindfulness were correlated with several hedonic and eudaimonic wellbeing constructs including positive affect, life satisfaction, optimism, relatedness, autonomy, competence and self-esteem. Randomised controlled trial (RCT) studies have found that mindfulness increases positive emotions (examples listed in Garland, Farb, Goldin & Fredrickson, 2015, p.10-11).

Theoretical explanations for the link between mindfulness and wellbeing

Researchers have proposed theories and hypotheses that could explain this link. Self-determination theory (Deci & Ryan, 1985) posits that people are motivated to develop a coherent sense of self, and to satisfy their needs for autonomy, competence and

relatedness. Experiencing these facilitates eudaimonic wellbeing. Brown and Ryan (2003) explain that mindfulness enables people to fulfil these needs by enhancing their awareness of needs-related prompts. Brown and Ryan also suggest a route from mindfulness to hedonic wellbeing; mindful awareness and attention enable richer, higher quality experience of the present moment, as well as deeper engagement with activities, enabling states of flow, known to be enjoyable and energising (Csikszentmihalyi, 1990).

Relevant to people in chronic pain, Garland et al. (2015) have developed mindfulness-to-meaning theory, which describes how mindful attention and decentring enable flexible "reappraisal of adversity and savouring of positive experience" (p. 293). This is proposed to lead to increased hedonic wellbeing and attention to positive aspects of experience, which they hypothesise could increase perceptions of events as meaningful and growth-promoting and thus more broadly foster meaningfulness and purpose in life (see Figure 1). Through the lens of this theory, mindfulness promotes both hedonic and eudaimonic wellbeing, even in the face of stress. Davis, Zautra and Smith (2004) also suggested that the increased emotional awareness associated with mindfulness may enable people with chronic pain to experience positive emotions, even during intense pain.

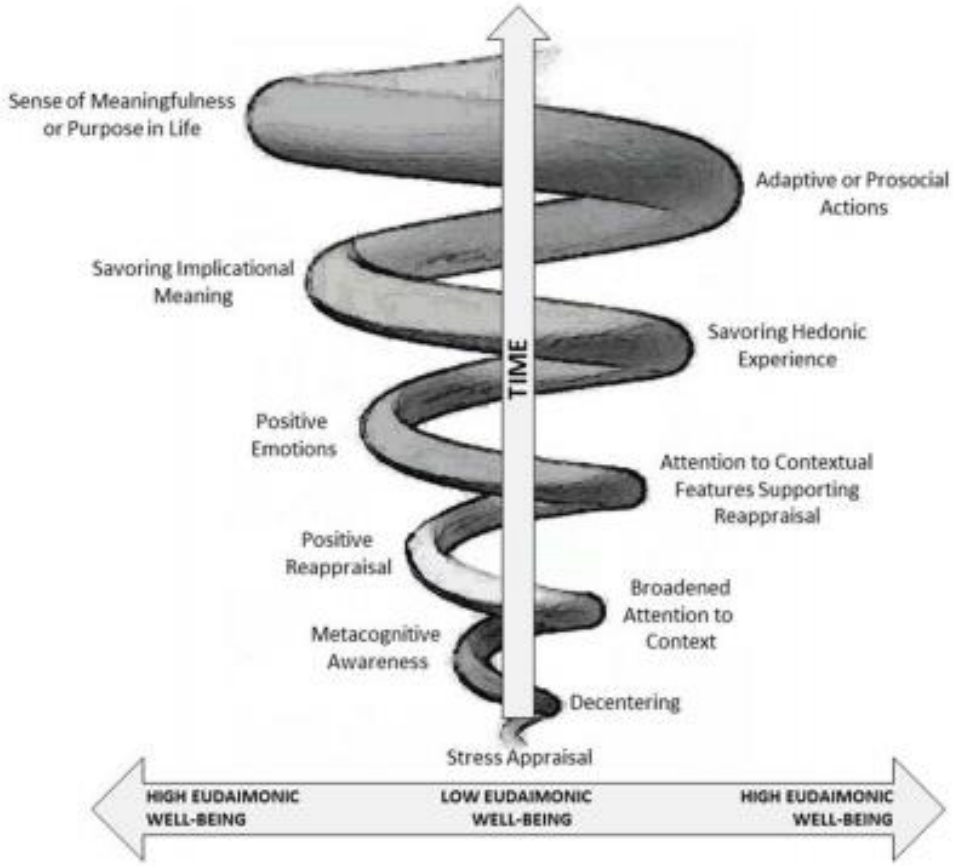

Figure 1. Mindfulness-to-meaning theory (Garland et al., 2015).

Mindfulness-based interventions

MBIs involve training the mind to attend intentionally and non-judgmentally to the present, "in an open, accepting, and discerning way" (Day, Jensen, Ehde & Thorn, 2014, p.692). This enables the practitioner to observe their emotions, thoughts and bodily sensations as transient, naturally varying experiences. Current reviews suggest that MBIs may improve quality of life and wellbeing in people with chronic pain (Chiesa & Serretti, 2011; Veehof et al., 2011; Veehof et al., 2016). However, unclear definitions of wellbeing and quality of life, lack of detailed focus on wellbeing as an outcome, and exclusion of results from qualitative studies and non-RCTs mean that the question of whether MBIs boost wellbeing in chronic pain sufferers has not been adequately answered.

Findings from previous reviews

Veehof et al. (2016) carried out a meta-analytic review of 25 RCTs of acceptance- and mindfulness-based interventions for people with chronic pain. They found small post-treatment effects on pain intensity, depression, disability and quality of life, and moderate effects on pain interference and anxiety. The effects generally increased at follow-up, with depression and quality of life becoming moderate and pain interference becoming large. Veehof et al. (2011) found moderate effects on pain intensity, depression, anxiety, physical wellbeing, and quality of life, but when low quality and non-controlled studies were excluded the effects on pain intensity reduced. Chiesa and Serretti (2011) reviewed the impact of mindfulness-based interventions (MBIs) on similar variables in chronic pain samples, and concluded that there was little evidence of specific effects of MBIs on pain or depression beyond what is seen in active control groups, but that better quality studies were needed. However, on the basis of improvements seen in pain tolerance, stress levels and quality of life, they concluded that MBIs could be useful for helping with these aspects without necessarily reducing pain intensity.

Definitions

Wellbeing

There is considerable debate over the definition of wellbeing and its constituent facets (Centers for Disease Control and Prevention, CDC, 2016). The present review is informed by the field of positive psychology, and thus concerns the psychosocial aspects of wellbeing, embodied in the concept of subjective wellbeing. The OECD's guidelines on measuring subjective wellbeing argue that it has three components (p.12): life evaluation (reflective assessment of life or an aspect of it), affect (the

balance of positive to negative emotions) and eudaimonia ("a sense of meaning and purpose in life, or good psychological functioning"). Keyes (2006) includes social wellbeing within this, as a public facet of positive functioning.

Quality of life

The Collins English dictionary online (n.d.) defines quality of life as "the general well-being of a person or society, defined in terms of health and happiness". Keyes (2006) describes subjective wellbeing as a fundamental facet of quality of life. Measures of quality of life therefore often overlap with those of wellbeing, though with a broader scope and more functional focus (e.g. quality of life scale, Burckhardt & Anderson, 2003). Linton et al. (2016) include measures of quality of life in their systematic review of wellbeing measures.

Mindfulness

Mindfulness is a way of intentionally paying attention to the present moment, in a non-judgmental, accepting and curious manner (Kabat-Zinn, 2003).

Chronic pain

Treede et al.'s (2015) definition of chronic pain stated above (p. 5) will be used for the purposes of this review.

The present review – rationale and focus

The aim of the present review is to evaluate the current evidence base for the effects of mindfulness training on wellbeing among adults with chronic pain. This differs from previous reviews of mindfulness for chronic pain, which have focused on 'negative' variables such as depression, anxiety and pain intensity (e.g. Veehof et al., 2016). The effects of MBIs on pain will also be briefly reviewed, to find out whether

any increases in wellbeing occur independently of improvements in pain. Qualitative studies will be reviewed to find out what people experiencing chronic pain say about the impact of mindfulness on their hedonic and eudaimonic wellbeing. Given previous findings that mindfulness is associated with increased positive emotions and eudaimonic wellbeing (Garland et al, 2015; Brown & Ryan, 2003), and that wellbeing can be experienced even in the context of chronic pain (Thompson, 2014), it is predicted that MBIs will enhance hedonia and eudaimonia among people with chronic pain, regardless of effects on pain.

Method

A mixed methods review was carried out to synthesise research on the impact MBIs on wellbeing in chronic pain. The research was critiqued according to the National Institute for Health and Care Excellence quality appraisal frameworks (NICE, 2012).

Literature search

A systematic literature search was conducted for research articles about chronic pain, wellbeing and mindfulness interventions using the databases PsycINFO, Applied Social Sciences Index & Abstracts (ASSIA) and MEDLINE. Google Scholar was used to check for any articles missed by these databases. The search terms used for each element of the search are listed in Table 1 and were combined with the Boolean operator 'AND'.

Table 1
Search terms

Concept	Search term

Chronic pain	pain OR headache OR sciatica OR migraine OR fibromyalgia OR arthritis
Wellbeing	“well being” OR wellbeing OR well-being OR "positive psychology" OR “positive emotion*” OR optimism OR happiness OR eudaimoni* OR hedoni*
Mindfulness	mindfulness OR meditation OR mind-body
Intervention	intervention OR treatment OR therapy OR program* OR group

References of the articles retrieved were hand searched for additional papers. Qualitative studies that collated participants’ comments about their wellbeing were included alongside quantitative intervention studies. This was to get a more in-depth view on the impact of mindfulness interventions on wellbeing, particularly given the inconsistent use of wellbeing terminology and measures among studies in the area of chronic pain.

Selection of research articles

Figure 2 shows the process of article selection using a PRISMA diagram format (Moher, Liberati, Tetzlaff & Altman, 2009). Both qualitative and quantitative research studies were considered for inclusion. All studies needed to assess the impact of an MBI on wellbeing, as defined above. Studies were included if they were available in English and reported on effects of an intervention that was mindfulness focused (such as MBSR, or ACT where formal mindfulness practice was a significant component); the participants were all aged 18 or over and suffered from chronic pain from any condition; and effects of the intervention on wellbeing were adequately measured (quantitative) or reported (qualitative).

Studies were excluded if the intervention was not predominantly mindfulness practice (such as ACT or CBT with a small component of mindfulness); if the intention of the intervention was not primarily mindfulness focused; if recruitment of participants was not based on having chronic pain; or if their measure of 'wellbeing' or 'quality of life' did not align with the definition of wellbeing provided above.

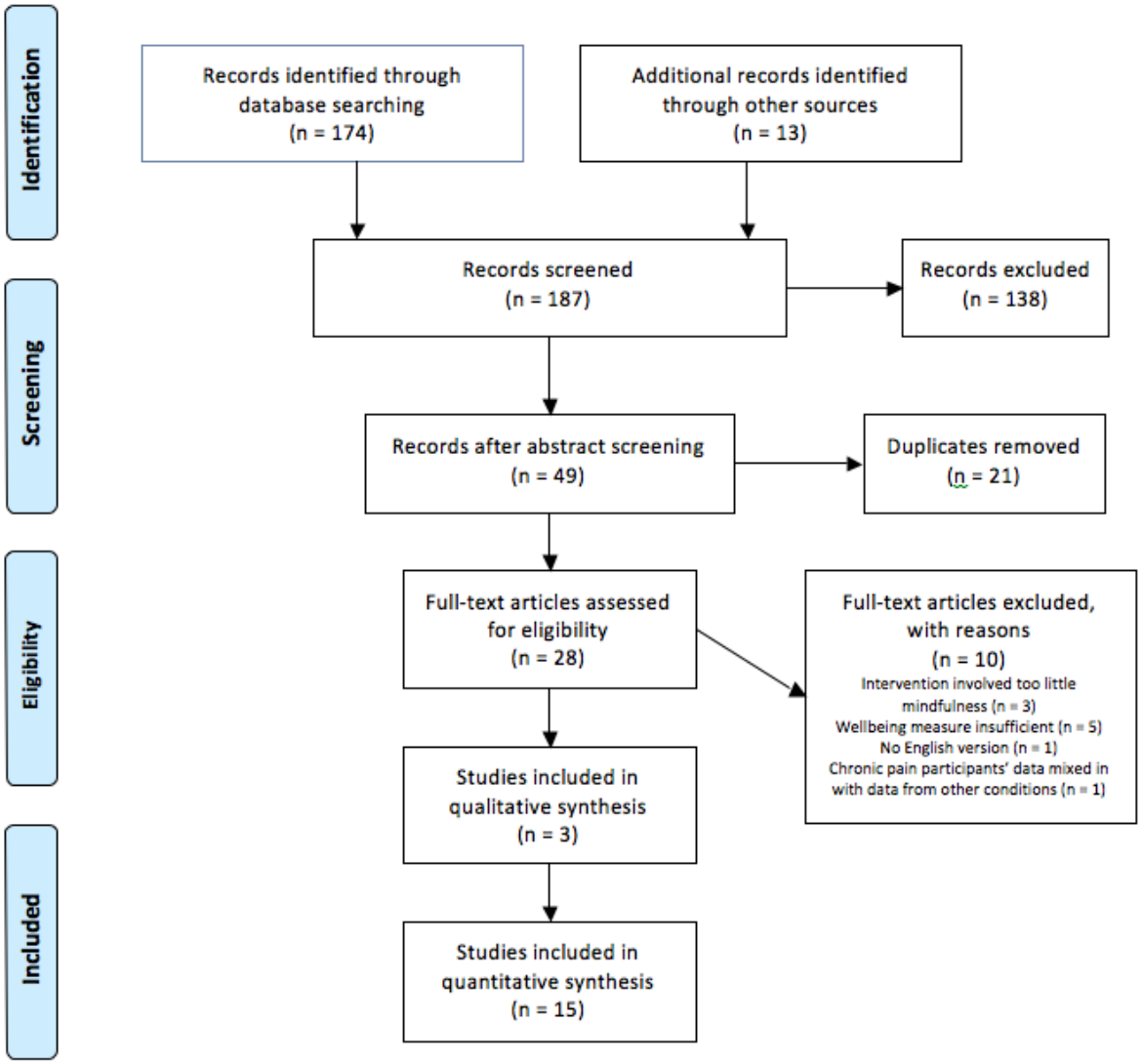

Figure 2. Process of selection of articles for review.

Summary of findings

Results from quantitative studies

Studies will be referred to using their numbers as allocated in Table 2. Studies 1 to 10 used face-to-face group interventions and studies 11 to 14 used computerised MBIs.

Characteristics of the included studies

All studies were carried out in Western Europe or the USA. Whilst the majority of studies (nine of fourteen) were RCTs, four had no control group and two did not fully randomize their participants into groups. Sample sizes ranged from ten (study 3) to 238 (study 14). Participants suffered from a range of chronic pain conditions including arthritis, fibromyalgia, headache, back pain, neuropathic pain, rheumatic pain and endometriosis. Four of the MBIs were computer-based (11-14) and the rest were delivered in groups. All MBIs expected participants to carry out individual meditations daily between sessions. Two of the computerised interventions (11, 14) were ACT-based, with strong mindfulness components, one was based on MBCT (13) and the other was an MBI targeting socio-emotional regulation (12). The group interventions were mostly standard or adapted MBSR, aside from study 1, which used the "Breathworks" program that situated mindfulness within its original Buddhist philosophy, and study 10, which used the personal construct theory-based "Vitality Training Programme".

How did the studies measure wellbeing?

Thirteen distinct measures of wellbeing were used, with almost every study employing a different tool. This reflects the confusing plethora of definitions, theories and constructs comprising the research base on wellbeing (Linton et al., 2016). To

enable comparison and synthesis of the results from the different measures, each tool (or subdomain where available) was categorised using the OECD (2013) guidelines for the measurement of wellbeing into either life evaluation (LE), positive affect (A) or eudaimonia (E). Social wellbeing facets were included in eudaimonia (Keyes, 1998). Categorisation decisions were based on the descriptions of measures, evaluation of items within the measures and factor analysis, where available in the literature. Appendix A presents a table of the list of measures with validity and reliability information, as well as the facets of wellbeing included in each one. The synthesis of results presented below is organised by these three facets of wellbeing.

Table 2

Quantitative studies retrieved

No	Lead author, date	Aim	Design	Intervention	Control condition	No of ppts	Attrition & adherence	Wellbeing outcome measures	Main findings relating to wellbeing	Effects on pain severity or intensity	Limitations
Section 1: Group-delivered intervention studies											
1	Cusens 2010	To examine the effect of a mindfulness program on wellbeing	Non-randomised controlled trial.	Breathworks mindfulness program. 10 weeks. Weekly 2.5 hour group sessions, plus daily practice	TAU	I: 33 C: 20	I: 3% C: 10%	DAPOS (positive outlook scales).	Significant group/time interaction effects found on depression and positive outlook (DAPOS), activity engagement and pain acceptance (CPAQ), catastrophizing and magnification (PCS).	Not significant	Not randomised and unclear whether analysis was blind. Adherence to home practice wasn't reported. No intention to treat analysis performed. No longer term follow-up. Power calculation not provided.

2	Grossman 2007	To test the benefits of MBSR for women with fibromalgia	Quasi-randomised controlled trial	Group MBSR program (mindfulness training, meditation and gentle yoga) 8 weeks	Social support, relaxation and stretching exercises	I: 39 C: 13	I: 10% C: 15% (then 8 intervention group participants lost to follow-up)	QoL	Significant improvements on all dimensions of QoL compared to control group from pre to post intervention. This effect significantly reduced by follow-up, but was still significantly higher than pre-intervention QoL. 76% of the intervention group continued to practice mindfulness at follow-up.	Significant improvement over time on VAS and compared to controls. Maintained at 3 year follow-up. Long term benefit not seen for other pain measures.	Not fully randomised. No male participants. Small control group that was not followed up at 3 years. No intention to treat analysis performed.
3	Kold 2012 (incl. corrigendum, Kold 2016) and Hansen 2017	To evaluate the feasibility of a mindfulness intervention for women with endometriosis and its long term effects on chronic pain and quality of life	Longitudinal observational	Group mindfulness training, psychoeducation and individual therapy. 10-session (five individual and five group sessions, 15 hours in total)	No control	10	None	SF-36 at baseline, post intervention, 6m, 12m & 6y follow-up. Quality of life Likert scale at 6y follow-up	Significant improvement in mental health and vitality domains of SF-36. Improvements on the SF36 were retained at follow-ups. Social functioning improved over the period to follow-up. 9/10 participants were still using mindfulness and all said their quality of life was better (5) or much better (5) compared to before the intervention.	EHP-30 pain significantly improved and was maintained at follow-up.	No control, small sample, two parts of the intervention were not mindfulness focused. No power analysis conducted.

4	Kaplan 1993	To test the effectiveness of a mindfulness based stress reduction program as a treatment for fibromyalgia	Before and after study	Mind body stress reduction program (MBSRP). In person group sessions and 50 minutes homework per day. 10 weeks	No control	77	23%	VAS: global wellbeing	51% of the participants were classed as "responders", who improved by >25% on >50% of the measures. No significant demographic differences between responders and non-responders. 64% of participants improved on global wellbeing and 90% said they gained something valuable from the course.	65% of participants improved by >25% on a pain VAS.	No control, no statistical data analysis. No follow-up. VAS outcome measures not tested for reliability and validity.
5	La Cour 2015	To investigate the effect of MBSR for patients with severe, long-lasting pain.	RCT	MBSR. In person group sessions with home practice. 8 weeks	Waitlist and standard care	I: 54 C:55	I: 20% C: 15%	SF-36 vitality and mental health	*Pilot study*: participants all said that they felt more alive and energetic. *Main study post intervention*: significant improvements in mental quality of life, anxiety. *Main study at 6m follow-up*: As above, and further improvement in depression, and pain acceptance.	Not significant at any time point. Improved pain acceptance and pain control.	Significantly longer pain duration in waitlist control group. Waitlist was not a comparable amount of face to face time. Only the intervention group was followed up. Multiple t tests used so increased chance of type 1 error, but reduced significance level accordingly.

6	Morone 2008a	1) assess feasibility of recruitment and adherence to an eight-session mindfulness program for older adults with CLBP. 2) gain estimates of treatment effects on measures of pain, physical function and quality of life	RCT	Eight-session mindfulness program in groups. Each session lasted 90 minutes. Daily homework of 45 minute meditation and 5 minute diary. 8 weeks	Waitlist	I: 19 C: 18	I: 32% C: 6%	SF-36 (vitality and positive affect)	No significant improvement in vitality or mental health on SF-36. Pain acceptance, activity engagement and physical function significantly increased. All other measures changed in the expected direction but not significantly. Most participants continued to meditate at 3 month follow-up.	Not significant (McGill Pain Questionnaire)	Waitlist comparison only and they weren't followed up. Attrition was higher in intervention group than control group. Possibly underpowered to detect between group differences.

7	Pradhan 2007	Whether mindfulness improves depressive symptoms, mindfulness, well-being, disease activity and psychological distress in people with rheumatoid arthritis.	RCT	MBSR. 8 weeks, plus 3 refresher courses over 4 months	Waitlist	I: 31 C:32	I: 10% C: 6% Median attendance was 8 sessions. Mean practice time: 1 hour per day 6 days per week. 86% were continuing to practice mindfulness at 6 month follow-up.	SPWB (eudaimonic wellbeing) at baseline, 2 months and 6 months	No significant differences between groups in any measures at 2 months. At 6 months, there was a significant group x time interaction for wellbeing and psychological distress, in favour of the intervention group.	Not significant (Disease Activity Score in 28 joints)	All participants with a history of depression were randomised to the control group by chance (this was adjusted for). Control group was inactive. Most participants were white, female, married and well educated.
8	Rosenzweig 2010	Compares treatment effects of MBSR among different types of pain (arthritis, fibro, headache, back/neck). Also looks at effects of home practice.	Prospective cohort	MBSR classes. In person group sessions and 20-25 minutes mindfulness practice per day. 8 weeks	No control	113	21%	SF-36 (vitality and positive affect)	Significant improvements on all sub-measures for the whole sample taken together. Arthritis patients experienced greatest gains in SF-36. More home practice was associated with greater improvements on some but not all subscales.	Not significant (SF-36 bodily pain)	No control, generalizability limited by predominantly Caucasian female well-educated employed sample. Only completers were included in the analysis (no ITT performed). No follow-up.

9	Zautra 2008	To examine the value of CBT for pain (P) and mindfulness for emotion regulation (M) to rheumatoid arthritis patients. Hypothesised that M would promote well-being	RCT	M: Mindfulness group intervention designed to a) reduce negative impact of stress and illness, and b) sustain positive social engagements despite pain P: Pain management focused CBT 8 weeks, 2 hour weekly sessions	Education on arthritis	M: 48 P: 52 C: 44	Attrition <10% for all conditions. Attendance was around 75% for P and M	PANAS (positive affect and negative affect) completed daily and averaged over 30 days	Positive affect significantly increased from pre to post for all groups, with a large effect size and M and P benefiting significantly more than E. Participants with a history of recurrent depression showed a significantly greater increase in positive affect in M than in E or P groups. All groups showed reduction in negative affect.	Significant improvement, small effect size	General level of impairment was low to moderate, so it is unclear how people with more significant pain would respond to the intervention.

10	Zangi 2012	To evaluate whether participation in the VTP could improve psychological well-being, self-efficacy and emotion-focused coping in adults with inflammatory joint diseases.	RCT	Vitality Training Programme (VTP). In person group sessions lasting 4.5 h each and addressing, through mindfulness, a specific topic related to living with chronic illness. 10 sessions and a 6 month booster session	Received a CD of mindfulness exercises for voluntary use at home, and fortnightly phone calls.	I: 36 C: 35	5% (and 1 person was excluded)	Wellbeing VAS	Significant treatment effects in favour of the VTP group were found post-treatment and at 12 months for wellbeing. Effects at both time points were also significant for the VTP group in psychological distress (GHQ-20), self-efficacy, pain and symptoms, emotional processing, self-care and fatigue. No significant change in pain levels	NRS, not significant	Only a small number of people who were invited actually enrolled in the study, so there is a possible selection bias towards highly motivated people. Baseline data were collected after randomisation. Measures all self-report.
Section 2: Computer-based intervention studies											
11	Buhrman 2013	To see whether a guided internet-based ACT program could help chronic pain patients	RCT	7 week Online ACT program featuring information about elements of ACT (e.g. values, acceptance, willingness) and regular mindfulness exercises	Moderated online discussion forum	I:38 C:38	I: 24% (3 after randomisation, 6 lost to follow-up) C: 16% (all lost to follow-up) Program completers: 39%	QOLI (Life satisfaction)	No significant effects on quality of life either at post-treatment or six month follow-up. Significant treatment effect on catastrophising and praying and hoping subscales of CSQ which were maintained at follow-up. Intention to treat analysis was performed.	MPI, not significant	Less than a third of ppl asked wanted to take part. Only the treatment group were followed up. Treatment group were more educated than controls. Adherence was only 39% to the whole program. Everyone was at varying stages of the program when outcome measures were collected (mean = 4/7). 20% of data was missing due to unanswered items.

12	Davis 2013	To compare effects of a mindfulness intervention targeting socio-emotional regulation with a control educational program.	RCT	Online mindfulness intervention targeting socio-emotional regulation via awareness of emotions and using mindful awareness to make choices that enhance social connection. 12 modules over 6 weeks	Health tips education program giving advice on healthy living.	I:39 C:40	I: 51% C: 37% (NS difference) Average adherence I: 8/12 modules C: 9/12	PANAS (positive affect scale, negative affect); NRS (stress coping efficacy, family enjoyment, social engagement)	Intervention group's increase in positive affect, social engagement, family enjoyment and pain and stress coping efficacy over time was significant in comparison with control group.	Not significant	Reasonably homogenous sample – unclear generalizability. No post-treatment follow-up. 1/3 of ppl asked didn't want to participate and those that did were paid (possible bias). Very high attrition.
13	Dowd 2015	To compare the effectiveness of online MBCT at reducing pain and psychological distress, with psychoeducation for people with chronic pain	RCT	6 week modified computerised MBCT, called Mindfulness in Action (MIA)	Computerized pain management psychoeducation	I: 62 C:62	I: 55% after T1, another 8% after T2. C: 40% after T1, another 16% after T2.	SWLS (life satisfaction) Modified version of PGIC (Ability to manage emotions, deal with stressful situations & enjoy pleasant events)	Both groups reported significant improvement in SWLS, pain interference, CPAQ and MAAS. Participants in MIA group experienced significantly greater gains in SWLS than psychoed group. SWLS continued to increase to follow-up, as did ability to manage stressful events and emotions.	Not significant	Very high attrition; reliance on self-report for how much of the intervention was completed; 90% sample were female; sample were from a research database so possible bias.

14	Trompetter 2015	To examine the effects of an online ACT course on people with chronic pain	RCT	Living with pain, a web-based ACT intervention involving daily mindfulness practice. Minimal guidance provided one day per week by clinical psychology students. 9-12 weeks, 30 mins per day	Expressive Writing (EW) or a Waiting List condition (WL)	238 I: 82 EW: 79 WL: 77	Attrition: 29% overall Self-reported adherence I:48% EW:47%	MHC-SF (Positive mental health), ELS (Engaged living)	No significant improvement on MHC or ELS compared to controls. Significant improvement compared to controls on many secondary outcomes including depression (HADS), pain catastrophising, mindfulness, psychological inflexibility, pain intensity and pain disability.	Pain intensity not significant	Small effect sizes and such a large number of measures and conditions mean that probability of type I error may be high. MHC not validated for people with chronic pain, and ELS is a new scale. Sample wasn't clinical and was more highly educated than typical patient. High attrition and low adherence rates.

Outcome measure abbreviations: DAPOS - Depression, Anxiety and Positive Outlook Scale; DAS28 - Disease Activity Score in 28 joints; EHP-30 - Endometriosis Health Profile; ELS - Engaged living scale; MHC-SF - Mental Health Continuum (short form); MPI - Multi-dimensional Pain Inventory; NRS - numeric rating scale; PANAS - Positive And Negative Affect Scale; PDI - Pain Disability Index; PGIC - Patient Global Impression of Change scale; QoL - Quality of Life profile for the chronically ill; QOLI - Quality Of Life Inventory; SF-36 - Short Form health survey; SPWB - Scales of Psychological Well-Being; SWLS - Satisfaction With Life Scale; VAS - visual analogue scale.

Do MBIs improve wellbeing in people with chronic pain?

One large (n=238) computer-based RCT, study 14, investigated the impact of mindfulness training on global subjective wellbeing. It compared an online MBI (n=82) to expressive writing (n=79) and waitlist (n=77) controls, using the mental health continuum (short form; MHC-SF; Keyes, 2009) to measure global wellbeing before intervention, after and at 6-month follow-up. No significant improvements were found, but with a 29% dropout rate and adherence to the program being below 50%, this seems unsurprising. When only MBI adherers were compared to controls, improvements on the MHC-SF approached significance (p=0.066). Although the MHC-SF questions covered all three elements of wellbeing discussed here, no subdomain scores were reported. This aligns with Jovanović's (2015) recommendation not to calculate separate scores for the three types of wellbeing due to the small amount of variance accounted for by these factors.

Life evaluation

Group-delivered studies

Three of the face-to-face studies reported on the effects of mindfulness on a measure of life evaluation (3, 4, 10).

In study 3, women with endometriosis who had participated in a group MBI were followed up after six years. They were asked "*How do you experience your general quality of life today compared with the time before the intervention?"* All women reported it to be better (50%) or much better (50%). Clearly over such a long period of time many factors could have contributed to this, such as life stage, other treatments, or natural improvement in the endometriosis over time. It may also have

been difficult for the participants to remember their quality of life six years previously for comparison. Support for the possible role of mindfulness in the improvement, however, comes from data that 90% of the women were still regularly using the mindfulness skills they learned in the intervention.

Studies 4 and 10 both asked participants to rate their global wellbeing on a visual analogue scale (VAS). Study 4 found that 67% of participants improved following completion of an MBSR program but the impact of their findings is weakened by the lack of any statistical analysis. Study 10 reported, using an ITT approach, that the MBI group's wellbeing scores improved significantly more than those of the control group ($p<0.001$), both after the intervention and at 12-month follow-up, with moderate effect sizes of 0.57 and 0.43 respectively.

Computer-delivered studies

Two computer-delivered studies investigated the effects of mindfulness on life evaluation (11, 13). Study 11 found no significant improvements in life satisfaction ($t(28)=0.55$, $p=0.59$). Study 13 reported significant improvements in life satisfaction in the MBI group relative to a control group who received online psychoeducation ($F=4.37$, $p=0.04$, $d=0.6$), and continued to improve to follow-up ($t=5.55$, $p<0.0001$). Both studies had attrition rates of over 20% and performed ITT analyses accounting for this. Study 13 had a particularly high drop-out rate (55% to post-intervention and a further 8% to follow-up), implying particularly good life satisfaction outcomes for those who did complete the program.

Overall findings for effects life evaluation

The majority of studies (four of five) reported improvements in people's evaluation of their quality of life, satisfaction with life or sense of global wellbeing. Effect sizes,

where reported, were moderate. However, the impact of these results in the group intervention studies is weakened by the failure of two studies to carry out statistical analysis. The two online studies had contrasting results leaving any conclusion unclear. Where follow-ups were carried out, improvements were retained, but equally the non-significant result perpetuated.

Affect

Affect was the most studied aspect of wellbeing, with nine of the fourteen quantitative studies investigating whether MBIs lead to increased positive affect.

Group-delivered studies

Seven group-delivered studies measured positive affect. Studies 1 and 9 used combined measures of positive and negative affect, and group by time interactions revealed significant increases in positive affect among MBI participants relative to control groups (F=10.15, p<0.01 and F=6.74, p<.001 respectively), with large effect sizes ($\eta 2p$[1]=0.21 and d=0.78 respectively). Study 9 also found that mindfulness outperformed CBT for chronic pain in terms of effects on positive emotion for participants with a history of depression (F=8.63, p<0.001). Study 1's impact is weakened by the use of a 'treatment as usual' control group and lack of randomisation to conditions. While non-randomisation could result in bias, at baseline there were no significant differences between the control and MBI groups on any measures. Study 1 also failed to perform ITT analysis, although their attrition rate was low (3%) among MBI participants so ITT may not have altered the outcomes significantly.

[1] Partial Eta squared. A small effect is 0.01–0.06, a medium effect is 0.06–0.14, and a large effect is 0.14 and higher.

Unfortunately neither of the studies followed up their participants, so it is unclear whether the benefits of mindfulness on positive emotion were maintained over time.

Study 2 saw significant increases in positive affect ($p<0.01$), and ability to experience joy and relax ($p<0.004$) over the course of an MBSR group. Both factors improved significantly more than a control group who received a very similarly structured program of social support, relaxation and stretching exercises without the mindfulness component. The average effect size for hedonic variables was large ($d=0.81$). This provides support for the added benefit of mindfulness to subjective wellbeing, although these conclusions are limited by a small control group and quasi-randomisation. Only the MBSR group were followed up three years later and, despite significant worsening on all measures compared to immediately post-intervention, their overall improvements at follow-up were still highly significant compared to before the intervention. Study 2 did not justify their lack of ITT analysis, despite 10% attrition from the MBI group, so these results may be an overestimation of the effectiveness of the intervention.

Four studies (3, 5, 6, 8) used the SF-36 (Ware, Kosinski, Dewey & Gandek, 2000) as a measure of health-related quality of life. Two of its dimensions align with the affect facet of wellbeing: mental health and vitality. The two studies (5 and 8) with the largest sample sizes (109 and 113 respectively) both found significant improvements in positive affect post-MBI; for study 5 these improvements were significant both for observed and ITT data compared to a waitlist control group ($p=0.01$). The studies reported moderate to large effect sizes of 0.63 and 0.8. Although study 5 used t-tests instead of ANOVA, they reduced the required significance level to balance the

increased possibility of type I error. Some limitations detract from study 8's findings, namely that it was not controlled and only included completers in the analysis despite 21% attrition. Nor did study 8 conduct a follow-up to see whether these improvements were maintained. Study 5's participants' affect scores had not significantly declined between the end of the intervention and six-month follow-up, suggesting that gains were maintained. Study 5 also used paired sample t-tests to investigate whether their waitlist control group made gains in positive affect following their participation in the MBI. Significant gains were made post intervention but these were only maintained for the vitality dimension at follow-up. Study 3 reported significant improvements on all facets of the SF-36 from baseline to post-intervention, at 6- and 12-month follow-up, and these were maintained at 6-year follow-up. Study 6, which had 32% attrition among the intervention group and may have been underpowered, saw trends in the expected direction but no significant results at any time point and a trivial effect size (d=0.17).

Computer-delivered studies

Two online studies (12, 13) measured the effect of mindfulness on positive emotion. Study 12 found a significant increase in positive affect among MBI participants relative to control groups (p<0.05), but the effect size was very small (d=0.03). Only half of study 12's participants completed the intervention, but ITT analysis was performed, which should reduce the possibility of a bias towards program completers being happier people.

Study 13 did not separate out the subdomains of the SWLS, so only the overall results are available for evaluating the effects of their computerised MBI on affect. As reported above (in 'life evaluation' section), the MBI group's scores on the SWLS

increased significantly post intervention compared to controls, and continued to improve to follow-up. They did, however, include an additional measure of change in "ability to enjoy pleasant events", finding that MBI participants scored significantly higher post intervention than controls who received psycho-education (p=0.025, d=0.41). This measure did not maintain significance to follow-up.

Overall findings for effects on positive emotion

In sum, eight of the nine studies found evidence of increased positive affect among participants who completed MBIs. Where the studies were controlled, this increase in positive emotion was significantly greater for the MBI groups, however two studies were not controlled (3, 8) and three studies did not use ITT analysis (1, 2, 8). Five studies followed up their participants (2, 3, 5, 6, 13), all finding that gains seen in positive affect post intervention were retained to some degree.

Eudaimonia

Group-delivered studies

Study 7 used the Ryff Scales of Psychological Well-Being (Ryff, 1989), which were designed to assess eudaimonia. Whilst the improvement in eudaimonia of the intervention group compared to controls was non-significant immediately post intervention, the group/time interaction had reached significance by 6-month follow-up (p=0.03) using observed data (similar results were obtained with ITT). Given that 86% of the participants were continuing to practice mindfulness at follow-up, this may suggest that improvement in eudaimonic wellbeing takes time and requires integration of mindfulness into daily life.

Study 2 found significant improvements compared to controls in social functioning and belonging (both p<0.004) among the 90% of participants who completed their

program. Gains were still significant at follow-up compared to baseline but ITT analysis was not conducted and no justification for this was presented.

Computer delivered studies

Specific aspects of eudaimonia were measured by the online studies, finding benefits for MBI participants over controls in social functioning (12, $p<0.05$) and managing stress (12, $p<0.01$; 13, $p<0.001$) using ITT. Improvements were maintained when participants were followed-up in study 13. While study 13 found a moderate effect size of 0.62, study 12's effect sizes of 0.014 and 0.015 were so small they suggest a lack of practical significance.

Study 14 measured valued living as part of the ELS, although unfortunately this subdomain was not analysed individually so it is unclear whether the non-significant improvement in the ELS also applied to the valued living subscale. Given strong correlations between the two subscales of the ELS (Trompetter et al., 2013), it is unlikely that a different pattern would emerge for valued living.

Overall findings for effects on eudaimonia

Although the results of study 2 appear very promising, its lack of ITT analysis and the delayed onset of improved eudaimonia in study 7 mean that overall the group-based interventions present a mixed picture. Negligible effect sizes in study 12 and non-significance of study 14's results mean that only a positive effect of mindfulness on stress coping efficacy (study 13) was found among the online studies.

Effects on pain severity/intensity

Ten of the fourteen studies found no significant improvement in pain severity following mindfulness training, or in the longer term where reported. Where significant improvements were found, these were of small effect size (study 9, in

which wellbeing improvement had a large effect size), very small sample size (study 3), did not calculate statistical significance (study 4) or included program completers only (study 2). Therefore improvement in pain severity was unlikely to have contributed to the improvements in wellbeing seen across the research.

Methodological limitations and strengths of the evidence base

With regard to the question posed, one limitation of the collective literature is the use of measures that only give a partial view of subjective wellbeing or are not validated (the use of VAS). The most popular measure was the SF-36, which is primarily a health quality of life measure. Health quality of life has tended to focus more on deficits in functioning (CDC, 2016) and its section on mental wellbeing reflects this, with only two questions asking about positive affect.

Given that participants involved in the research trials had to commit to mindfulness training that generally took eight weeks or longer, there is a likelihood of selection bias towards people motivated and able to make such a commitment. Where it is reported, generally large proportions of those asked were not interested in participating (10, 11, 12, 13). However, those that did choose to participate in the group MBIs tended to engage well with the interventions. Average dropout for groups was 12%, with all but three (4, 6, 8) reporting attrition rates below 20% (range = 0-32%), and high levels of adherence to the program where it was reported. The computerised interventions, on the other hand, suffered from high levels of attrition (mean = 40%, range = 20-55%) suggesting difficulty with adherence and motivation in the absence of social support.

Nearly all studies presented appropriate statistical analysis of their data and were sufficiently powered to detect intervention effects. Studies generally used ITT analysis (except 1, 2 and 8), thereby providing realistic assessments of the effects of the MBI as a whole, not just for those who complete it. Seven of the nine studies that reported effect size achieved moderate or large effects on subjective wellbeing, implying meaningful improvements for participants. Participants were often not followed up, or only the intervention group was followed up, meaning that it was difficult to make confident conclusions about the effectiveness of MBIs in the longer term. However, the four studies (2, 3, 6, 7) that asked their participants about continued engagement in practice at follow-up found that over 75% of participants had integrated mindfulness into their lives.

Diversity was a limitation identified in many of the studies, with female participants substantially outnumbering male participants in all but one study, and, where ethnicity was reported, Caucasians forming the vast majority of participants. Where education was reported, half of the studies (4, 7, 8, 14) experienced a bias in participants towards higher levels of education. The location of the non-UK trials in Western Europe and the USA suggests the results are applicable to a UK context due to the similarity of culture and demographics in these regions. However, the literature reveals nothing about the appropriateness and acceptability of MBIs outside this context, nor for people living in the UK who have come from a non-Western culture.

Overall, the best quality evidence came from RCT studies that used valid and reliable wellbeing measures, took steps to ensure unbiased allocation to conditions, recruited large samples that stayed the course of the intervention, carried out ITT analysis and

followed up their participants. Few studies met all these criteria (5, 7). Among the others, common limitations were lack of follow-up (1, 4, 8, 9, 12), failure to complete ITT analysis (1, 2, 8), small sample sizes (3, 6), high attrition, especially among the computer-based studies (11, 12, 13, 4, 6, 8 all experienced over 20% attrition), and problems with controls, including not having a control group (3, 4, 8) and non-random allocation (1, 2). Studies chose participants appropriately, including adherence to unbiased randomisation procedures among the RCTs. The collective studies provided comprehensive descriptions of the interventions and comparisons and there were no incidences of possible confounding identified.

Qualitative studies: What do people with chronic pain say about the impact of mindfulness training on their wellbeing?

Characteristics of qualitative studies

Only three qualitative studies were retrieved that investigated the impact of mindfulness training on wellbeing in adults with chronic pain. A summary of them is presented in Table 3.

Participants. Study 15 had a small number of participants, with predominantly arthritis (four out of five). Study 16 presented a qualitative analysis of the diaries of 27 participants from study 6, all older adults with chronic lower back pain. Study 17 randomly selected ten participants from an RCT investigating effects of an MBI on fibromyalgia.

Interventions. All participants in each study had taken part in an eight session, group-based mindfulness program. Whilst study 15 and 16's interventions were based on MBSR, study 17's intervention, meditation awareness training (MAT), was overtly spiritual and more closely tied to ancient Eastern meditation traditions.

Table 3
Qualitative papers retrieved

No	Lead author, date	Aims	Sample	Method and analysis	Main findings	Limitations
15	Hawtin, 2011	To investigate participants' experiences of mindfulness in relation to pain and psychological wellbeing.	5 adults aged 46-69 with arthritis (4) or fibromyalgia (1) who had completed an 8-week hospital-based group MBSR program and 3 month follow-up together. All were under the care of a rheumatology consultant.	Focus group 6 months after the end of the MBSR facilitated by first author (who also ran the MBSR). IPA used to draw out codes, which were consolidated into themes.	Two themes emerged: Responding to pain, and psychological wellbeing. Participants described mindfulness as having changed their responsiveness to pain, especially accepting rather than battling it and changing focus of attention. They described a shift towards more positive and less negative affect attributed to mindfulness. Participants continued their commitment to mindfulness practice.	Focus group hindered ability to explore individual experience in depth. Small sample size may have limited interaction in focus group. Focus group facilitator was also mindfulness teacher and OT for participants.
16	Morone, 2008b	To identify the effects of mindfulness meditation on older adults with chronic low back pain (CLBP)	27 adults ≥ 65 years with CLBP of at least moderate severity and of at least three months duration.	Diary entries throughout group mindfulness course and comments at follow-up were analysed using content analysis to develop codes, which were applied to the data to develop themes, taking a grounded theory approach.	Six themes emerged: pain reduction from mindfulness meditation; improvement in attention skills; improved sleep resulting from meditation; achieving well-being; barriers to meditation; and processes of meditation. Participants said that their quality of life had improved overall, as well as getting immediate boosts in positive emotion from meditation.	Narrow sample, although findings are probably generalizable more broadly. Adherence to diary completion fell to 1/3 by the end of the study.
17	Van Gordon, 2016	To explore whether, following participation in an MBI, patients with fibromyalgia have changes in (i) how they experience and relate to their illness and (ii) their attitudes towards societal participation, work and unemployment.	10 randomly selected adult participants (age 29-64, one male) from the intervention arm of an RCT that used a modified version of an MBI known as Meditation Awareness	Semi-structured interview was carried out within a 1-1 support session, which was part of the MAT. Interpretative Phenomenological Analysis (IPA).	Five main themes were: (i) reservations about participating, (ii) improvements in psychosomatic well-being, (iii) spiritual growth, (iv) awareness of impermanence and (v) increased sense of citizenship. MAT was experienced as both an acceptable and accessible	Interview was interspersed with a support session, which could bias the responses.

	Training (MAT) for the treatment of fibromyalgia

Data collection and analysis. Study 15 used interpretative phenomenological analysis (IPA, Smith and Osborn, 2008) of participants' accounts and interactions with each other in focus groups, held six months after the MBI. Study 17 also used IPA but gathered accounts through individual semi-structured interviews integrated into a support session during the final week of the course. Study 16 reported the results of their grounded theory-based content analysis (Glaser and Strauss, 1967) of participants' daily diary entries written during the course of the MBI.

Synthesis of qualitative findings

The findings from the qualitative studies were considered in terms of hedonic and eudaimonic wellbeing, in keeping with the quantitative evaluations. All three studies found themes of these facets of wellbeing in their data. Life evaluation did not emerge clearly as a separate theme from the qualitative literature and is therefore not differentiated.

Hedonic wellbeing

Increased positive affect was identified as a theme in all studies. Participants spoke about feeling happier both immediately after meditation and more generally, which they attributed to the mindfulness training. The positive emotions experienced included happiness, relaxation, energy, peace and serenity. These were backed up with quotes such as "it gives me a peaceful feeling while doing it" and "I'm happier now". Study 15's participants reported that others had noticed their improved mood, such as "I feel better, you know, and people have said that – you're smiling more".

Eudaimonic wellbeing

The qualitative studies found that engaging in mindfulness training was associated with increased appreciation of life, increased acceptance (15), quality of life, ability to manage difficult aspects of life (16), spiritual development (17) agency and sense of citizenship (17). Study 16 reported life-altering changes among participants, such as "my quality of life has stepped up a notch" and "a huge change in my personality and outlook". Study 17's participants described profound effects on their eudaimonic wellbeing, especially in relation to spiritual growth experienced as a result of the mindfulness program. Many of them described being on a spiritual journey as a result of increased curiosity about their spiritual self. The journey gave a sense of eudaimonic wellbeing, for example "I'm definitely getting stronger. I've got something to work towards now. I'm on a spiritual journey and it's probably the most important thing I've ever done in my life." It also motivated participants and increased their sense of agency to contribute more to society and increase others' wellbeing. Quotes reinforced this, such as "If I think positively, I can make things better. I don't just mean for me but for everybody", and "I've got something to give. I've got a role to play in helping [other people]". Two participants from study 17 made the decision to return to work following the MBI. It is important to consider study 17's results in the context that the MBI delivered had a lot of spiritual content, being more rooted in the Eastern tradition from which mindfulness originated than the other MBIs. The heightened attention to spirituality inherent in this clearly influenced the benefits gained by participants.

The role of mindfulness training in improvements in wellbeing

Comments from the participants explicitly linked these hedonic and eudaimonic wellbeing changes to mindfulness training. Saying, for example, that mindfulness

practice had a regenerating effect (study 16), that learning mindfulness had changed participants' attitude to life and increased their awareness. The increase in awareness was perceived as having led to getting more joy from everyday situations. For example, "I've always enjoyed nature but now I'm noticing more ... and I get a sense of peace and wellbeing from it, more so than ... before." Nearly all of study 17's participants attributed their improvements in wellbeing to spiritual growth from the program, for example "when I feel nourished spiritually, I feel better all over". Study 17 also found that participants linked mindfulness to coping better with pain, and that being able to cope enabled a better overall quality of life and positive feelings to flourish.

Methodological issues

As with the quantitative studies, lack of diversity was an issue within the qualitative literature. Study 16's sample was predominantly white older adults, and study 17's sample were all female except one, all unemployed except one, all educated up to school level except one, and predominantly middle-aged. No data was provided on demographics in study 15.

One characteristic of the themes found in the qualitative analyses and the evidence presented within these themes was a scarcity of discrepant results. It may be that people's experience of the MBIs was highly consistent, but possible sources of bias should also be considered. The two studies that gathered data in person from participants (15 & 17) both used the program instructor as interviewer. While study 15 hypothesised that this would have helped participants to feel comfortable, such a relationship between the researcher and participants could have made it difficult for participants to say negative things about the intervention. Furthermore, study 15

collected data via focus groups, opening up the possibility for groupthink to influence what was said (Janis, 1972). It is also possible that there was a disconnect between participants' experiences and their interpretation by research teams. Although all studies had their data coded by two researchers independently, Study 17 was the only one to gather feedback from participants themselves on the themes that emerged.

Study 16 collected diaries from participants throughout the MBI. However diaries were not handed in consistently. Most people handed them in during the first three weeks but it reduced steadily over the course of the program, providing the researchers with information about participants' early responses to the program but little about its effects on their wellbeing over time.

Study 15 provided few quotes for each theme and its themes were rather broad. This limitation may stem from their use of focus groups to carry out IPA, which should normally look at individual's experiences in depth. Using a focus group potentially prevents deep exploration of individual's experiences.

Discussion

Overall synthesis of findings and implications for theory

This paper reviewed the contribution of the research literature to the question of whether mindfulness interventions improve subjective wellbeing in people experiencing chronic pain. Quantitative MBI studies were reviewed, including RCTs, quasi and non-randomised controlled studies, and non-controlled studies, to examine the impact of MBIs on participants' evaluations of their life and scores on measures

of hedonic and eudaimonic wellbeing. Qualitative studies were reviewed to add depth to the data through MBI participants' reflections about changes to their wellbeing. Based on theory and former research, it was predicted that MBIs would have positive impacts on subjective wellbeing, including hedonic and eudaimonic wellbeing and life evaluation. This prediction was borne out by the majority of studies, but the overall evidence is mixed due to some insignificant results and some methodological limitations.

At first glance, the quantitative literature found significant improvements in participants' evaluations of their life after participating in MBIs. However, the studies that assessed life evaluation were limited by unvalidated measures (4 and 10), small sample size (3) and inadequate analysis (3 and 4). This left only study 13 demonstrating robust evidence of an effect on life satisfaction. Study 14, which measured life evaluation as part of subjective wellbeing, found no significant overall improvement. Thus only tentative support is provided by this review for the possibility of improving life satisfaction through MBIs, as might be inferred from Brown and Ryan's (2003) findings of an association between trait mindfulness and life satisfaction. However, Kong et al. (2014) found that the association between mindfulness and life satisfaction was mediated entirely by core self-evaluations. It seems likely that eight-week MBIs are insufficient to substantially change such longstanding beliefs.

Positive affect was widely researched by the quantitative studies. Despite some methodological limitations, overall they provided support for the prediction that mindfulness training would improve hedonic wellbeing, with eight of nine studies

reporting significant increases in measures of positive emotion. Effect sizes for the group-based studies, where reported, were mostly large. By contrast the effect sizes for the two computer-based studies were medium and very small. Findings from the qualitative literature indicated that participants felt more positive emotions such as happiness, serenity and relaxation both immediately after meditation and more generally.

The qualitative findings that an increase in participants' awareness to the present moment had led to more joy supports both Brown and Ryan (2003)'s and Garland et al.'s (2015) theories of mindfulness leading to increases in hedonic wellbeing, through savouring and engagement in the present. Other research has found that mindfulness strengthens positive associations (van Vugt, Hitchcock, Shahar & Britton, 2012) and makes positive memories easier to access (Roberts-Wolfe, Sacchet, Hastings, Roth & Britton, 2012), potentially adding to the explanation for increased hedonia experienced by MBI participants. It is interesting, however, that the qualitative results from study 6/16 contradict the quantitative results. Perhaps the SF-36 is an inadequate measure of positive affect, or a few very positive experiences skewed the qualitative analysis.

The evidence for benefits to eudaimonic wellbeing from MBIs for people with chronic pain was more mixed. While five quantitative studies assessed eudaimonic wellbeing to some degree, only study 7 measured eudaimonia comprehensively, which unusually only reached significant levels of improvement at 6-month follow-up. Other studies provided some support for improvements to aspects of eudaimonia such as stress coping efficacy and social functioning, but conclusions remain tentative

due to small effect sizes (12) and lack of ITT analysis (2). The qualitative studies provided stronger support for improvements to eudaimonia, with results suggesting that participants of MBIs developed an increased sense of purpose, meaning and better social and psychological functioning. These findings support a role for mindfulness in helping people move from patient to person and occupy themselves, consistent with Thompson's (2014) theoretical description of people who cope well with chronic pain. The combined findings also tentatively support mindfulness-to-meaning theory's (Garland et al., 2015) assertion that mindfulness increases eudaimonic wellbeing.

The intention of this review was not to look in depth at reduction in pain severity, which has been adequately reviewed elsewhere (e.g. Chiesa & Serretti, 2011; Veehof et al., 2016). These reviews found that reductions in pain intensity are minimal yet reductions in distress from pain are substantial. In keeping with this, a brief assessment of the effects of the MBIs on pain intensity among the studies reviewed here found that none of the fourteen studies reported convincing improvements in the level of pain. This supports the prediction that MBIs would increase subjective wellbeing independently of any improvements in pain. It also provides further support for Thompson's (2014) findings that wellbeing is possible in the context of chronic pain. Therefore, in keeping with conclusions from Chiesa and Serretti's (2011) review, the present review indicates that MBIs are better suited to focusing on improving psychological wellbeing and distress from pain, rather than pain severity.

The attrition rates seen in the group mindfulness trials (mean = 12%) were slightly lower than findings from other reviews of MBIs (e.g. Baer, 2003 (15%); Veehof et al.,

2011 (19%), 2016 (25%)) but overall the level of dropout suggests that participants find group MBIs acceptable. The mean 40% dropout among participants of computerised MBIs in the present review mirrored the 37% attrition reported in a recent review of self-help mindfulness and acceptance programs (Cavanagh, Strauss, Forder and Jones, 2014). Taken together, these are indicative of a general trend towards lower participant engagement with self-help MBIs. The lower engagement was reflected in the results; only two of the computerised MBIs found significant improvements in wellbeing, and of these one had a very small effect size.

Implications for clinical practice

Chronic pain can have a devastating effect on wellbeing and, so far, both psychological and pharmaceutical treatments aimed at reducing pain have had limited success. Typically, psychologically focused chronic pain treatments have sought to reduce pain and associated psychological distress. The present review argues that it is equally important for clinical psychologists to focus on improving positive aspects of quality of life, empowering people to live well with pain where possible. This view is supported by WHO's (2014) assertion that wellbeing is more than the absence of symptoms.

Henderson and Knight (2012) stress that hedonic and eudaimonic pursuits are both important for 'flourishing', and that a life rich in both is associated with the highest levels of subjective wellbeing. Applied to chronic pain, Ong, Zautra, and Carrington Reid (2015) contend that a focus on enhancing and sustaining positive emotions is "likely to play an important role in minimizing the burden of pain, fostering emotional recovery from stress, and improving the overall functioning of those with

chronic pain" (p.284). DeVellis, Lewis, & Sterba (2003) make a similar case for pursuing activities that enhance eudaimonic wellbeing despite pain, suggesting that these may be essential for sustaining both psychological and physical functioning. The tentative findings of this review for the enhancement of hedonic and eudaimonic wellbeing through mindfulness mean that clinicians could consider promoting mindfulness for developing wellbeing alongside pain- and distress-focused treatments.

The results of this literature review support previous assertions that reducing pain intensity is not the most effective focus of MBIs for people with chronic pain (Chiesa & Serretti, 2011). Clinicians should be clear with patients that mindfulness interventions are not likely to reduce the intensity or severity of their pain, but could help them to cope better with pain and enjoy a better standard of psychological wellbeing. This is in alignment with the British Psychological Society's ethical principle of integrity (BPS, 2009).

Implications for future research

Although the present review provides evidence for beneficial effects of MBIs on subjective wellbeing, none of the interventions delivered were specifically designed with this intention in mind. Intention is important in mindfulness practice for connecting people with their goals, and is believed to substantially influence the outcome (Shapiro, Carlson, Astin & Freedman, 2006). It follows, therefore, that participants' gains may be greater if they were to practice mindfulness with the explicit intention of improving hedonic and eudaimonic wellbeing. Ivtzan et al. (2016) have developed a mindfulness program that incorporates positive psychology

into mindfulness practice in a mutually supportive relationship aimed at increasing subjective wellbeing. This could be tested on a chronic pain sample.

Due to the current financial strain on the NHS, and particularly cuts to mental health budgets (British Medical Association, 2017), low cost options for treatments targeting mental health outcomes are needed. Research should be carried out into the effectiveness and acceptability of wellbeing interventions that involve fewer staff resources, such as computerised programs. Given the finding in this review that attrition rates were higher for computerised MBIs, future research should investigate reasons for dropouts and consider ways of making online MBIs more engaging. Even if research finds that online treatments are less effective than group interventions, a strong empirical base will provide evidence of the importance of funding face-to-face psychological interventions.

The literature base for investigating wellbeing among people with chronic pain was heavily weighted towards female participants. A large cross-cultural general population prevalence study (Tsang et al., 2008) found that between 47.5-55% of people reporting chronic pain were women, depending on the country surveyed. This strongly suggests that there is a bias in the research towards recruiting women. Possible reasons for this could be that women are more open to mindfulness as an intervention (Katz & Toner, 2013), suffer more from their pain (Sullivan, Tripp & Santor, 2000), more likely to seek help for their pain (Smith, Braunack-Mayer, & Wittert, 2006), or more likely to sign up to research trials. It therefore seems valuable to carry out research into the wellbeing of men with chronic pain, including their

perspectives on what types of intervention, if any, would be appealing to improve their wellbeing.

The complexity of conducting this review in the context of so many different definitions and measures of wellbeing lends support to existing calls for a more unified approach to the study of wellbeing (CDC, 2016). Given the importance of fostering both hedonic and eudaimonic wellbeing to help people live well with chronic pain (Ong et al., 2015), intervention studies should gage the impact on these positive variables alongside traditional symptom-focused measures.

Conclusion

The current literature base provides some promising evidence for a positive impact of MBIs on hedonic wellbeing, and tentative evidence for improvements to life evaluation and eudaimonic wellbeing. More methodologically rigorous research is needed that specifically aims to improve and measure subjective wellbeing in this population.

References

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical psychology: Science and Practice*, *10*(2), 125-143. DOI: 10.1093/clipsy/bpg015

British Medical Association (2017, February 7). Mental health budgets cut [online article]. Accessed from https://www.bma.org.uk/news/2017/february/mental-health-budgets-cut

British Psychological Society (2009, August). *Code of ethics and conduct: Guidance published by the Ethics Committee of the British Psychological Society*. Leicester: British Psychological Society. Accessed from https://beta.bps.org.uk/sites/beta.bps.org.uk/files/Policy%20-%20Files/Code%20of%20Ethics%20and%20Conduct%20%282009%29.pdf

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*(4), 822. doi:10.1037/0022-3514.84.4.822

Buhrman, M., Skoglund, A., Husell, J., Bergström, K., Gordh, T., Hursti, T., ... & Andersson, G. (2013). Guided internet-delivered acceptance and commitment therapy for chronic pain patients: a randomized controlled trial. *Behaviour research and therapy*, *51*(6), 307-315. doi:10.1016/j.brat.2013.02.010

Burckhardt, C. S., & Anderson, K. L. (2003). The quality of life scale (QOLS): reliability, validity, and utilization. *Health and quality of life outcomes, 1*(1), 60. doi:10.1186/1477-7525-1-60

Cavanagh, K., Strauss, C., Forder, L. and Jones, F. W. (2014) Can mindfulness and acceptance be learnt by self-help?: A systematic review and meta-analysis of mindfulness and acceptance-based self-help interventions. *Clinical Psychology Review, 34*(2). pp.118-129. http://dx.doi.org/10.1016/j.cpr.2014.01.001

Centers for Disease Control and Prevention (2016, May 31). *Well-being concepts*. Retrieved from https://www.cdc.gov/hrqol/wellbeing.htm#eight

Chiesa, A., & Serretti, A. (2011). Mindfulness-based interventions for chronic pain: a systematic review of the evidence. *The Journal of Alternative and Complementary Medicine, 17*(1), 83-93. doi:10.1089/acm.2009.0546

Crawford, J. R., & Henry, J. D. (2004). The positive and negative affect schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*(3), 245-265. doi:10.1348/0144665031752934

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal performance.* New York: Harper Collins.

Cusens, B., Duggan, G. B., Thorne, K., & Burch, V. (2010). Evaluation of the Breathworks mindfulness-based pain management programme: effects on well-being and multiple measures of mindfulness. *Clinical Psychology & Psychotherapy, 17*, 63-78. doi:10.1002/cpp.653

Davis, M. C., Zautra, A. J., & Smith, B. (2004). Chronic pain, stress, and the dynamics of affective differentiation. *Journal of Personality, 72*(6), 1133–1159. http://doi.org/10.1111/j.1467-6494.2004.00293.x

Davis, M. C., & Zautra, A. J. (2013). An online mindfulness intervention targeting socioemotional regulation in fibromyalgia: results of a randomized controlled trial. *Annals of Behavioral Medicine, 46*(3), 273–284. doi:10.1007/s12160-013-9513-7

Day, M. A., Jensen, M. P., Ehde, D. M., & Thorn, B. E. (2014). Toward a theoretical model for mindfulness-based pain management. *The Journal of Pain*, *15*(7), 691-703. doi:10.1016/j.jpain.2014.03.003

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*(2), 109-134. doi:10.1016/0092-6566(85)90023-6

DeVellis, R. F., Lewis, M. A., & Sterba, K. R. (2003). Interpersonal emotional processes in adjustment to chronic illness. In Suls, J. & Wallston, K., *Social psychological foundations of health and illness* (pp. 256–287). Oxford: Blackwell. doi:10.1002/9780470753552.ch10

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*(1), 71-75. doi:10.1207/s15327752jpa4901_13

Dowd, H., Hogan, M. J., McGuire, B. E., Davis, M. C., Sarma, K. M., Fish, R. A., & Zautra, A. J. (2015). Comparison of an online mindfulness-based cognitive therapy intervention with online pain management psychoeducation: a randomized controlled study. *The Clinical Journal of Pain, 31*(6), 517-527. doi:10.1097/ajp.0000000000000201

Fayaz, A., Croft, P., Langford, R. M., Donaldson, L. J., & Jones, G. T. (2016). Prevalence of chronic pain in the UK: a systematic review and meta-analysis of population studies. *BMJ Open, 6*(6), e010364. doi:10.1136/bmjopen-2015-010364

Frisch, M. B., Cornell, J., Villanueva, M., & Retzlaff, P. J. (1992). Clinical validation of the Quality of Life Inventory. A measure of life satisfaction for use in treatment planning and outcome assessment. *Psychological Assessment, 4*(1), 92-101. http://dx.doi.org/10.1037/1040-3590.4.1.92

Garland, E. L., Farb, N. A., Goldin, P. R., & Fredrickson, B. L. (2015). The mindfulness-to-meaning theory: extensions, applications, and challenges at the attention–appraisal–emotion interface. *Psychological Inquiry, 26*(4), 377-387. doi:10.1080/1047840x.2015.1092493

Glaser, B. & Strauss, A. (1967). *The Discovery of Grounded Theory*. Aldine Publishing Company, Hawthorne, NY.

Grossman, P., Tiefenthaler-Gilmer, U., Raysz, A., & Kesper, U. (2007). Mindfulness training as an intervention for fibromyalgia: evidence of postintervention and 3-year follow-up benefits in well-being. *Psychotherapy and Psychosomatics*, *76*(4), 226. DOI: 10.1159/000101501

Hansen, K. E., Kesmodel, U. S., Kold, M., & Forman, A. (2016). Long-term effects of mindfulness-based psychological intervention for coping with pain in endometriosis: A six-year follow-up on a pilot study. *Nordic Psychology*, *69*(2), 100–109. doi:10.1080/19012276.2016.1181562

Hawtin, H., & Sullivan, C. (2011). Experiences of mindfulness training in living with rheumatic disease: an interpretative phenomenological analysis. British Journal of Occupational Therapy, 74(3), 137–142. doi:10.4276/030802211x12996065859283

Henderson, L.W., & Knight, T. (2012). Integrating the hedonic and eudaimonic perspectives to more comprehensively understand wellbeing and pathways to wellbeing. *International Journal of Wellbeing*, *2*(3), 196-221. doi:10.5502/ijw.v2i3.3

Ivtzan, I., Young, T., Martman, J., Jeffrey, A., Lomas, T., Hart, R., et al. (2016). Integrating mindfulness into positive psychology: A randomised controlled trial of an online positive mindfulness program. *Mindfulness*, *7*(6), 1396–1407. doi:10.1007/s12671-016-0581-1

Janis, I. L. (1972). *Victims of groupthink: a psychological study of foreign-policy decisions and fiascoes*. Oxford, England: Houghton Mifflin.

Jovanović, V. (2015). Structural validity of the Mental Health Continuum-Short Form: The bifactor model of emotional, social and psychological well-being. *Personality and Individual Differences, 75*, 154–159. doi:10.1016/j.paid.2014.11.026

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry, 4*(1), 33–47. https://doi.org/10.1016/0163-8343(82)90026-3

Kabat- Zinn, J. (2003). Mindfulness- based interventions in context: past, present, and future. *Clinical Psychology: Science and Practice*, *10*(2), 144-156. doi:10.1093/clipsy/bpg016

Kaplan, K. H., Goldenberg, D. L., & Galvin-Nadeau, M. (1993). The impact of a meditation-based stress reduction program on fibromyalgia. *General Hospital Psychiatry*, *15*(5), 284–289. doi:10.1016/0163-8343(93)90020-o

Katz, D., & Toner, B. (2013). A systematic review of gender differences in the effectiveness of mindfulness-based treatments for substance use disorders. *Mindfulness, 4*(4), 318-331. doi:10.1007/s12671-012-0132-3

Keyes, C. L. M. (1998). Social well-being. *Social Psychology Quarterly*, *61*(2), 121-140. doi:10.2307/2787065

Keyes, C. L. (2002). The Mental Health Continuum: From Languishing to Flourishing in Life. *Journal of Health and Social Behavior*, *43*(2), 207-222. https://doi.org/10.2307/3090197

Keyes, C. L. (2006). Subjective well-being in mental health and human development research worldwide: An introduction. *Social Indicators Research*, *77*(1), 1-10. DOI: 10.1007/s11205-005-5550-3

Keyes, C. L. M. (2009). *Mental health continuum--short form*. PsycTESTS Dataset. doi:10.1037/t30592-000

Kold, M., Hansen, T. G. B., Vedsted-Hansen, H., & Forman, A. (2012). Mindfulness-based psychological intervention for coping with pain in endometriosis. *Nordic Psychology*, *64*(1), 2–16. http://dx.doi.org/10.1080/19012276.2012.693727

Kold, M., Hansen, T., Vedsted-Hansen, H., & Forman, A. (2016). " Mindfulness-based psychological intervention for coping with pain in endometriosis": Corrigendum. *Nordic Psychology*, *68*(2), 144-146, DOI: 10.1080/19012276.2016.1162494]

Kong, F., Wang, X., & Zhao, J. (2014). Dispositional mindfulness and life satisfaction: The role of core self-evaluations. *Personality and Individual Differences*, *56*, 165-169. http://dx.doi.org/10.1016/j.paid.2013.09.002

La Cour, P., & Petersen, M. (2015). Effects of mindfulness meditation on chronic pain: a randomized controlled trial. *Pain Medicine, 16*(4), 641–652. doi:10.1111/pme.12605

Lamers, S., Westerhof, G. J., Bohlmeijer, E. T., ten Klooster, P. M., & Keyes, C. L. (2011). Evaluating the psychometric properties of the mental health continuum- short form (MHC- SF). *Journal of Clinical Psychology*, *67*(1), 99-110. DOI: 10.1002/jclp.20741

Laubach, W., Schröder, C., Siegrist, J. & Brähler,E. (2001). Standardization of the Questionnaire "Quality of Life with Chronic Disease" on a Representative German Sample. *Zeitschrift für Differentielle und Diagnostische Psychologie, 22*(2), 100-110. https://doi.org/10.1024//0170-1789.22.2.100

Lazarus, R. S., Kanner, A. D., & Folkman, S. (1980). Emotions: A cognitive-phenomenological analysis. *Theories of Emotion*, *1*, 189-217. doi:10.1016/b978-0-12-558701-3.50014-4

Linton, M. J., Dieppe, P., Medina-Lara, A., Watson, L., & Crathorne, L. (2016). Review of 99 self-report measures for assessing well-being in adults: Exploring dimensions of well-being and developments over time. *British Medical Journal Open*, *6*, e010641. https://doi.org/10.1136/bmjopen-2015-010641

McCracken, L. M., & Morley, S. (2014). The psychological flexibility model: A basis for integration and progress in psychological approaches to chronic pain management. *The Journal of Pain, 15*, 221–234. doi:10.1016/j.jpain.2013.10.014

Melzack, R., & Katz, J. (2001). The McGill Pain Questionnaire: Appraisal and current status. In D. C. Turk & R. Melzack (Eds.), *Handbook of pain assessment* (pp. 35-52). New York: Guilford Press.

Moher, D., Liberati, A., Tetzlaff, J, & Altman, D.G., The PRISMA Group (2009). Preferred reporting items for systematic reviews and metaanalyses: The PRISMA statement. *Public Library of Science - Medicine, 6*(7), e1000097. doi:10.1371/journal.pmed1000097

Morone, N. E., Greco, C. M., & Weiner, D. K. (2008). Mindfulness meditation for the treatment of chronic low back pain in older adults: A randomized controlled pilot study. *Pain, 134*(3), 310–319. doi:10.1016/j.pain.2007.04.038

Morone, N. E., Lynch, C. S., Greco, C. M., Tindle, H. A., & Weiner, D. K. (2008). "I felt like a new person." The effects of mindfulness meditation on older adults with chronic pain: qualitative narrative analysis of diary entries. *The Journal of Pain : Official Journal of the American Pain Society, 9*(9), 841–848. http://doi.org/10.1016/j.jpain.2008.04.003

NICE (2016, November). *Low back pain and sciatica in over 16s: assessment and management*. London, UK: National Institute for Health and Clinical Excellence. Retrieved from https://www.nice.org.uk/guidance/NG59

NICE (2012, September). *Methods for the development of NICE public health guidance (third edition).* London, UK: National Institute for Health and Clinical Excellence. Retreived from: https://www.nice.org.uk/process/pmg4/

Organisation for Economic Co-operation and Development (OECD, 2013). *OECD Guidelines on Measuring Subjective Well-being*. OECD publishing. Retrieved from http://dx.doi.org/10.1787/9789264191655-en

Ong, A. D., Zautra, A. J., & Reid, M. C. (2015). Chronic pain and the adaptive significance of positive emotions. *American Psychologist, 70*(3), 283–284. doi:10.1037/a0038816

Pavot, W., & Diener, E. (2008). The satisfaction with life scale and the emerging construct of life satisfaction. *The Journal of Positive Psychology*, *3*(2), 137-152. doi:10.1080/17439760701756946

Pincus, T., de C Williams, A. C., Vogel, S., & Field, A. (2004). The development and testing of the depression, anxiety, and positive outlook scale (DAPOS). *Pain*, *109*(1), 181-188. doi:10.1016/j.pain.2004.02.004

Pincus, T., Rusu, A., & Santos, R. (2008). Responsiveness and construct validity of the depression, anxiety, and positive outlook scale (DAPOS). *The Clinical Journal of Pain*, *24*(5), 431-437. doi: 10.1097/AJP.0b013e318164341c

Pradhan, E. K., Baumgarten, M., Langenberg, P., Handwerger, B., Gilpin, A. K., Magyari, T., … Berman, B. M. (2007). Effect of Mindfulness-Based stress reduction in rheumatoid arthritis patients. *Arthritis & Rheumatism, 57*(7), 1134–1142. doi:10.1002/art.23010

Price, C. (2012). National pain audit final report. *Health Quality Improvement Partnership*. Retrieved from http://www.nationalpainaudit.org/media/files/NationalPainAudit-2012.pdf

Quality of life (n.d.). In *Collins English Dictionary online*. Retrieved from https://www.collinsdictionary.com/dictionary/english/quality-of-life

Roberts-Wolfe, D., Sacchet, M., Hastings, E., Roth, H., & Britton, W. (2012). Mindfulness training alters emotional memory recall compared to active controls: support for an emotional information processing model of mindfulness. *Frontiers in Human Neuroscience, 6*. doi:10.3389/fnhum.2012.00015

Rosenzweig, S., Greeson, J. M., Reibel, D. K., Green, J. S., Jasser, S. A., & Beasley, D. (2010). Mindfulness-based stress reduction for chronic pain conditions: Variation in treatment outcomes and role of home meditation practice. *Journal of Psychosomatic Research, 68*(1), 29–36. doi:10.1016/j.jpsychores.2009.03.010

Rusk, R. D., & Waters, L. E. (2013). Tracing the size, reach, impact, and breadth of positive psychology. *The Journal of Positive Psychology*, *8*(3), 207-221. https://doi.org/10.1080/17439760.2013.777766

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*(6), 1069. doi:10.1037/0022-3514.57.6.1069

Seligman, M. (2011). *Flourish: a visionary new understanding of happiness and well-being*. New York: Free Press.

Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62*(3), 373–386. doi:10.1002/jclp.20237

Siegrist J, Broer M, Junge A. (1996). *Profil der Le bensqualität chronisch Kranker. Handanweisung*. Göttingen: Beltz Test.

Smith, J. A., & Osborn, M. (2008). Interpretative phenomenological analysis. *Doing Social Psychology Research*, 229–254. doi:10.1002/9780470776278.ch10

Smith, J., Braunack-Mayer, A., & Wittert, G. (2006). What do we know about men's help-seeking and health service use? *The Medical Journal of Australia, 184*(2), 81-83. Retrieved from: https://www.mja.com.au/system/files/issues/184_02_160106/smi10282_fm.pdf

Sullivan, M. J., Tripp, D. A., & Santor, D. (2000). Gender differences in pain and pain behavior: the role of catastrophizing. *Cognitive Therapy and Research, 24*(1), 121-134. doi:10.1023/a:1005459110063

Thompson, L. B. (2014). *Living well with chronic pain: A classical grounded theory* (Doctoral dissertation). University of Canterbury, New Zealand.

Treede, R. D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., ... & Giamberardino, M. A. (2015). A classification of chronic pain for ICD-11. *Pain*, *156*(6), 1003. DOI: http://dx.doi.org/10.1097/j.pain.0000000000000160

Trompetter, H. R., Bohlmeijer, E. T., Veehof, M. M., & Schreurs, K. M. (2015). Internet-based guided self-help intervention for chronic pain based on Acceptance and Commitment Therapy: a randomized controlled trial. *Journal of Behavioral Medicine*, *38*(1), 66-80. doi:10.1007/s10865-014-9579-0

Trompetter, H. R., Ten Klooster, P. M., Schreurs, K. M., Fledderus, M., Westerhof, G. J., & Bohlmeijer, E. T. (2013). Measuring values and committed action with the Engaged Living Scale (ELS): Psychometric evaluation in a nonclinical sample and a chronic pain sample. *Psychological Assessment*, *25*(4), 1235. doi:10.1037/a0033813

Tsang, A., Von Korff, M., Lee, S., Alonso, J., Karam, E., Angermeyer, M. C., ... & Gureje, O. (2008). Common chronic pain conditions in developed and developing countries: gender and age differences and comorbidity with depression-anxiety disorders. *The Journal of Pain*, *9*(10), 883-891. doi:10.1016/j.jpain.2008.05.005

Turk, D. C., & Okifuji, A. (2002). Psychological factors in chronic pain: evolution and revolution. *Journal of Consulting and Clinical Psychology*, *70*(3), 678. https://doi.org/10.1037//0022-006x.70.3.678

Turk, D. C., Wilson, H. D., & Cahana, A. (2011). Treatment of chronic non-cancer pain. *The Lancet, 377*, 2226–2235. doi:10.1016/S0140-6736(11)60402-9

Van Gordon, W., Shonin, E., & Griffiths, M. D. (2015). Meditation Awareness Training for Individuals with Fibromyalgia Syndrome: an Interpretative Phenomenological Analysis of Participants' Experiences. *Mindfulness, 7*(2), 409–419. doi:10.1007/s12671-015-0458-8

Van Vugt, M. K., Hitchcock, P., Shahar, B., & Britton, W. (2012). The effects of mindfulness-based cognitive therapy on affective memory recall dynamics in depression: A mechanistic model of rumination. *Frontiers in Human Neuroscience, 6*. doi:10.3389/fnhum.2012.00257

Veehof, M. M., Oskam, M. J., Schreurs, K. M., & Bohlmeijer, E. T. (2011). Acceptance-based interventions for the treatment of chronic pain: a systematic review and meta-analysis. *Pain*, *152*(3), 533-542. https://doi.org/10.1016/j.pain.2010.11.002

Veehof, M. M., Trompetter, H. R., Bohlmeijer, E. T., & Schreurs, K. M. G. (2016). Acceptance- and mindfulness-based interventions for the treatment of chronic pain: a meta-analytic review. *Cognitive Behaviour Therapy*, *45*(1), 5–31. doi:10.1080/16506073.2015.1098724

Ware Jr, J. E. (2000). SF-36 health survey update. *Spine*, *25*(24), 3130-3139.

Ware, J. E., Kosinski, M., Dewey, J. E., & Gandek, B. (2000). *SF-36 health survey: manual and interpretation guide*. Quality Metric Inc.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063. DOI: 0022-35l4/88

World Health Organisation (2014, August). *Mental health: a state of well-being*. Accessed from http://www.who.int/features/factfiles/mental_health/en/

Zangi, H. A., Mowinckel, P., Finset, A., Eriksson, L. R., Høystad, T. Ø., Lunde, A. K., & Hagen, K. B. (2011). A mindfulness-based group intervention to reduce psychological distress and fatigue in patients with inflammatory rheumatic joint diseases: a randomised controlled trial. *Annals of the Rheumatic Diseases, 71*(6), 911–917. doi:10.1136/annrheumdis-2011-200351

Zautra, A. J., Davis, M. C., Reich, J. W., Nicassario, P., Tennen, H., Finan, P., … Irwin, M. R. (2008). Comparison of cognitive behavioral and mindfulness meditation interventions on adaptation to rheumatoid arthritis for patients with and without history of recurrent depression. *Journal of Consulting and Clinical Psychology, 76*(3), 408–421. doi:10.1037/0022-006x.76.3.408

SECTION B: EMPIRICAL PAPER

Improving subjective wellbeing in people experiencing chronic pain using a Mindfulness-Based Flourishing program: a randomised controlled trial

Word count: 7466 (136)

Salomons - Canterbury Christ Church University

April 2018

A thesis submitted in partial fulfilment of the requirements of Canterbury Christ Church University for the degree of Doctor of Clinical Psychology

Abstract

Objectives: This study aimed to test the impact of an internet-delivered Mindfulness-Based Flourishing program (MBF) on subjective wellbeing in a sample of adults with chronic pain.

Materials and methods: Fifty-seven adults who experienced chronic pain were randomly assigned to either the MBF or to a waitlist control condition. Outcome measures were taken via an online survey before and after the four-week intervention, and after a further four weeks. A complete case analysis approach was used, which included 30 of the original sample.

Results: The MBF led to increases in subjective wellbeing and mindfulness that reached significance by follow-up, and increased health quality of life at both time points compared to controls. Effect sizes were medium to large. A reduction in pain catastrophising was also seen in the MBF group over time. Widespread pain and symptom severity did not change significantly compared to controls. Significant correlations were observed between subjective wellbeing, health quality of life and all other variables at baseline.

Discussion: Despite being underpowered, the study showed promise for the MBF to be used as an intervention for improving wellbeing in chronic pain. Replication is necessary to strengthen the evidence, and future studies could investigate the mechanisms of change.

Introduction

Chronic pain is a common complaint among adults, with adult prevalence estimated at 43.5% in the UK (Fayaz, Croft, Langford, Donaldson & Jones, 2016). The National Pain Audit (Price, 2012) reports that severe chronic pain negatively affects all aspects of a person's health and impacts heavily on quality of life; for example on sleep, relationships, employment, and mood. Interventions aimed at reducing pain itself, whether pharmacological, surgical, physiotherapy or alternative, rarely succeed in eliminating pain and often achieve little or no relief (Turk, Wilson, & Cahana, 2011). Medical interventions can also make pain worse or have serious side effects, but GPs often have few alternatives to offer (Cartagena et al., 2017; Smyth, 2018; Volkow, Benveniste & McLellan, 2018).

One alternative to medical intervention was offered in a recent call to action published in the Lancet (Buchbinder et al., 2018). The authors promoted a 'positive health' approach to non-specific low back pain. Positive health encourages self-management and adaptation in the face of physical, social and emotional challenges; the authors argued that our focus should be on enabling high quality and meaningful lives for people with chronic pain, rather than on treatment and cures. Psychological approaches are well suited to this positive health approach to pain management of helping people to live well, despite pain (e.g. McCracken & Vowles, 2014; Davis & Zautra, 2013).

Closely related to positive health is the concept of subjective wellbeing, which refers to 'a person's cognitive and affective evaluations of his or her life' (Diener, Oshi & Lucas, 2002, p. 63), and consists of positive emotional states (hedonic wellbeing) as

well as social functioning, meaning, and development of potential (eudaimonic wellbeing). Experiencing positive emotions despite chronic pain boosts recovery from pain and stress, reduces their burden, and improves overall functioning (Ong, Zautra & Reid, 2015). Thompson (2014) also found that achieving eudaimonic wellbeing is possible for people living with chronic pain. People who were coping well with chronic pain were not overly focused on pain reduction, but decided to turn from patient to person, occupy themselves and develop future plans. These findings merit a focus on developing interventions that improve hedonic and eudaimonic wellbeing among people with chronic pain.

In line with Thompson's (2014) findings, research in the field of positive psychology has indicated that a level of wellbeing is possible even in the context of mental or physical illness (Bergsma, Have, Veenhoven & Graaf, 2011). Positive psychology interventions (PPIs) have been developed to improve wellbeing by focusing on variables such as positive emotions, engagement, positive relationships, meaning and accomplishment (Seligman, 2011) and have had experimental success (Parks & Biswas-Diener, 2013). A meta-analysis of PPIs found a small to moderate effect (d=0.34) on subjective wellbeing in general population samples and people with 'psychosocial' problems (Bolier et al. 2013).

Recently, research has begun to investigate whether PPIs can improve wellbeing for people with chronic pain. Peters et al. (2017) found that an internet-delivered PPI achieved a significant increase in happiness compared to a waitlist control, with a large effect size similar in magnitude to a CBT comparison group. A feasibility study (Muller et al., 2016) demonstrated benefits for people with chronic pain of another

online PPI, including improved life satisfaction and positive affect alongside reduced pain and emotional symptoms. However they did not find improvements in pain acceptance or long-term improvements in positive affect. Peters et al. suggested that a PPI could complement another pain management intervention.

Mindfulness is used as a psychological approach both for helping people manage chronic pain (Kabat-Zinn, 1982; Veehof, Trompetter, Bohlmeijer and Schreurs, 2016) and for increasing wellbeing (Rybak, 2012). In terms of managing chronic pain, reviews of acceptance- and mindfulness-based interventions (MBIs) for chronic pain have found small effects on pain, but larger effects on pain interference and emotional outcomes that, unlike effects on pain intensity, increased at follow-up (Veehof et al., 2016; Veehof, Oskam, Karlein, Schreurs & Bohlmeijer, 2011). These findings suggest mindfulness interventions are better focused on living well despite pain rather than reducing pain itself.

Western adaptations of mindfulness such as Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 1982) and Mindfulness-Based Cognitive Therapy (MBCT; Teasdale et. al, 2002) have tended to focus primarily on deficit reduction, but evidence reveals that they also improve positive outcomes such as positive affect (Geschwind, Peeters, Drukker and Wichers, 2011) and social relationships (Goleman, 2006). Mindfulness to meaning theory (Garland, Farb, Goldin & Fredrickson, 2015) proposes that mindfulness increases subjective wellbeing by increasing savouring of positive experiences and enabling flexibility of thought to reappraise adversity.

Mindfulness may also help increase wellbeing in the context of chronic pain. Davis, Zautra and Smith (2004) suggested that the increased emotional awareness associated with mindfulness may enable people with chronic pain to experience positive emotions, even during intense pain. Among populations with chronic pain, some MBIs have succeeded in increasing hedonic wellbeing (Zautra et al., 2008; Cusens, Duggan, Thorne & Burch 2010; Grossman, Tiefenthaler-Gilmer, Raysz & Kesper, 2007) and eudaimonic wellbeing (Pradhan, 2007; Grossman et al., 2007). However, a limitation of the mindfulness in chronic pain literature is the paucity of comprehensive outcome measures of wellbeing. Many pain studies use health quality of life measures, such as the SF-36 (Ware, 2000), to assess wellbeing, but health quality of life is a different concept, focusing more on deficits in functioning (Centers for Disease Control and Prevention, 2016), as reflected by the SF-36's section on 'mental wellbeing', which has only two questions about positive affect. Furthermore, the intention of most MBIs for chronic pain is to reduce symptoms, rather than enhance wellbeing.

Shapiro, Carlson, Astin, and Freedman (2006) emphasise the role of intention in influencing the experience and outcomes of mindfulness practice, because Shapiro (1992) found that the benefits meditators derived from their practice were congruent with their aims. Therefore shifting the focus of mindfulness from reduction of pain and distress to wellbeing should enhance wellbeing outcomes. Some support for this idea exists. For example, compassion focused meditation increases affection towards others, connectedness and prosocial behaviour (Hutcherson, Seppala & Gross, 2008; Leiberg, Klimecki & Singer, 2011). In a chronic pain context, Van Gordon, Shonin and Griffiths (2015) studied the qualitative responses of adults with fibromyalgia to

Meditation Awareness Training (MAT). Unlike other Western MBIs, MAT was overtly spiritual and intended to cultivate positive attributes such as citizenship, generosity, compassion and patience. Participants reported life-changing benefits consistent with these intentions, including improved wellbeing, spiritual growth and increased citizenship.

Given evidence for the effectiveness of mindfulness and early indications that PPIs could benefit people with chronic pain, this study tested an intervention that combined these two approaches. The MBF[2] (Ivtzan et al., 2016) is an intervention that combines mindfulness training, positive psychology theory, and PPIs into an online program that explicitly targets increased subjective wellbeing. In line with its intention, Ivtzan et al. found in a randomised controlled trial (RCT) that the MBF improved wellbeing in a general population sample. A cross-cultural validation study also found increases in mindfulness and wellbeing measures (self-compassion, meaning in life, positive and negative emotions, and gratitude) for both Chinese and British adults following engagement with the MBF (Ivtzan et al., 2017). The program is administered online, which is cheaper and more flexible than delivering it face-to-face. Evidence suggests online mindfulness programs can be as effective as face-to-face programs in reducing anxiety, depression and stress (Krusche, Chylarova, King & Willams, 2012). No intervention that combines mindfulness with positive psychology has yet been tested with a chronic pain population, so this study investigated the effectiveness, feasibility and acceptability of the MBF in this context.

Study aims and hypotheses

[2] Previously called the Positive Mindfulness Program.

The primary aim of this study was to investigate whether the MBF improves mindfulness and subjective wellbeing among adults with chronic pain. The study also sought to establish whether the MBF reduces pain catastrophising and pain and symptom severity, and whether it improves health quality of life. We predicted that the MBF group would show significant increases from pre-intervention to post-intervention in wellbeing and mindfulness (primary dependent variables), and health quality of life as well as reduction in pain catastrophizing (secondary dependent variables) compared to the waitlist control group. As reviews have found MBIs to result in minimal pain reduction (Chiesa & Serretti, 2011; Veehof et al., 2016), we did not expect to see an effect of the MBF on symptom severity or widespread pain. Given previous research that the benefits of computerised MBIs on wellbeing can last months beyond the end of the intervention (Dowd et al., 2015), we predicted that gains would be maintained at follow-up four weeks following the end of the MBF.

Methods

Design

The study used a randomized waitlist control trial design with three time points: pre-intervention (T1), post-intervention (T2), and one-month follow-up (T3). Simple randomization using an online random number generator was used to allocate participants upon entry to the study. A ratio of 2:1 was used to over-select for the intervention group due to anticipated higher attrition rates in the intervention group than the control group (Ivtzan et al., 2016). The between-subjects independent variable was group (MBF or waitlist). The within-subjects independent variable was time (baseline, post-intervention and follow-up). The primary dependent variables

were mindfulness and wellbeing. The secondary dependent variables were pain, pain catastrophising, and health quality of life.

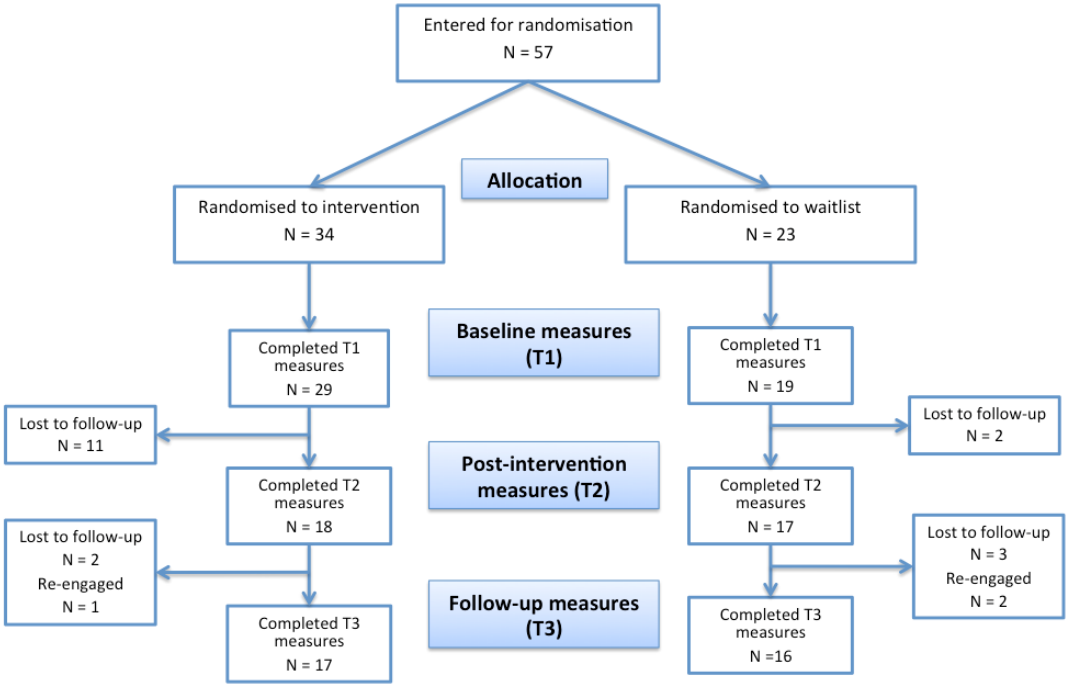

Figure 1. Flow chart of participants at each stage.

Participants

Participants were recruited from two pain management services in the southeast of England as well as by word of mouth. Participation was entirely voluntary and all participants who completed the study were offered the chance to enter a prize draw for one of two £50 vouchers. Participants were screened via email or telephone to ensure adherence to the following inclusion and exclusion criteria.

Participants were eligible for inclusion in the study if they were over 18 years old, had experienced pain for longer than 3 months and had access to a device connected to the Internet. Participants were excluded from the study if they were due to begin a new psychological intervention within 8 weeks of joining the study, or were experiencing posttraumatic stress disorder, eating disorder or substance abuse.

One prospective participant was excluded prior to randomization due to not meeting the inclusion criteria. Fifty-seven participants were randomized into the study, 48 of whom completed the baseline measures, comprising an original intervention group of 29 and a control group of 19. Rates of completion of the measures at each time point are presented in Figure 1. For the intervention group, 18 (62%) completed measures at T2, and 17 (59%) at T3. For the control group, 17 (89%) completed measures at T2, and 16 (84%) at T3. Thirty participants completed measures at all three time points, hereafter called the complete-case (CC) group, of which 16 were in the intervention group and 14 in the control group.

Table 1 describes the baseline demographic characteristics of all participants. Of the 48 participants who provided data at T1, 34 (71%) were female. The majority were educated to undergraduate degree level or higher (60%). Participants all suffered from chronic pain lasting at least 3 months, with the majority (81%) reporting pain of over 2 years' duration and 50% over 5 years' duration. Five participants had engaged in regular meditation prior to entering the study, four of whom were randomized to the intervention condition. There were no significant differences between the intervention and control groups on any demographic variable. Demographics were also analysed for the CC group (n=30; see Appendix B), and equally no significant differences were found.

Table 1
Participant demographics for whole sample

Baseline characteristics	All (n = 48)	MBF (n = 29)	Waitlist (n = 19)
Age M (SD)	47.79 (14.20)	49.90 (13.17)	44.58 (15.45)
Gender			
Male	14	9	5
Female	34	20	14

Education			
School	6	5	1
College	13	8	5
Undergraduate	18	10	8
Postgraduate	11	6	5
Main source of pain			
Back pain	13	9	4
Fibromyalgia	6	5	1
Arthritis	5	2	3
Chronic widespread pain	7	3	4
Headache	4	3	1
Neuropathic pain	5	2	3
Other	8	5	3
Duration of pain			
3 - 12 months	2	1	1
13 months - 2 years	7	5	2
2 to 5 years	15	7	8
> 5 years	24	16	8
Meditated regularly in past (weekly for > 6m)			
Yes	5	4	1
No	43	25	18

Sample size and power calculation

Previous computerised MBI studies have found effect sizes of up to $d = 0.6$ for wellbeing outcomes for people with chronic pain (Dowd et al., 2015) and two previous controlled trials of the MBF (Ivtzan et al., 2016; 2017) found average effect sizes of 0.38 and 0.67 on wellbeing variables respectively. Our sample size calculations therefore sought to detect a medium effect size of $d = 0.5$ for primary outcome variables at a power value of 0.8. Cohen (1992) recommends a sample size of 64 to test the hypothesis that the MBF would improve wellbeing.

Materials

The intervention and outcome measures were all accessed online via links emailed to participants.

Intervention description

The MBF (Ivtzan, 2016) consists of eight modules, each comprising a video that explains an aspect of positive psychology theory, and a corresponding daily meditation and PPI. A summary of the topics and exercises is provided in Table 2. Participants were instructed to practice each meditation and PPI for four days before moving on to the next topic, making the intervention last 32 days.

Table 2

Outline of MBF eight topics and activities (from Ivtzan et al., 2016)

Module	Topic	Theory Video	Meditation	Daily Practice
1	Self-Awareness	Introduction to mindfulness, self-awareness, positive psychology and meditation	Introductory meditation focusing on awareness of breath, body and emotions	Keeping aware of thoughts and reactions throughout the day
2	Positive emotions	Discussion of the benefits of positive emotions and gratitude	Gratitude meditation focusing on who or what one appreciates	Expressing gratitude for positive situations
3	Self-compassion	Explanation of the self-compassion concept, research review, and methods to increase self-compassion	Adapted version of Loving Kindness meditation focusing on self-compassion (Neff & Germer, 2013)	Replacing internal criticism with statements of kindness
4	Self-efficacy	Introduction to character strengths and self-efficacy including enhancement methods	Meditation focusing on a time when participant was at his/her best and using character strengths	Completing the VIA character strengths questionnaire (Peterson, & Seligman, 2006) and using strengths
5	Autonomy	Introduction to autonomy and its connection with wellbeing	Meditation on authentic self and action	Taking action in line with one's values and noticing external pressure on choices
6	Meaning	Discussion of meaning and wellbeing. Completion of writing exercise, "Best Possible Legacy" adapted from the Obituary Exercise (Seligman, Rashid & Parks, 2006)	Meditation on future vision of self, living one's best possible legacy	Acting according to best possible legacy. Choosing meaningful activities
7	Positive relations with others	Discussion of benefits of positive relationships and methods for relationship enhancement	Loving Kindness Meditation (Scheffel, 2003)	Bringing feelings of loving-kindness into interactions

8	Engagement	Introduction to engagement and savouring and their connection with positive emotions	Savouring meditation focusing on food	Using savouring to engage with experiences
	Conclusion	Summary of the program. Discussion of personal growth and invitation to keep meditating.		

Outcome measures

Mindfulness was measured using the Freiburg Mindfulness Inventory, Short Form (FMI) (Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006). This 14-item scale asks respondents to rate how frequently they are able to be mindful, using statements such as "I am open to the experience of the present moment" and "I watch my feelings without getting lost in them". The measure has good internal reliability in a UK sample (Walach et al. 2006).

Subjective wellbeing was assessed using the PERMA profiler (Butler & Kern, 2016), which is based on Seligman's (2011) PERMA theory of wellbeing. The 23-item instrument measures aspects of both hedonic and eudaimonic wellbeing, including: Positive emotion, Engagement, positive Relationships, Meaning, Accomplishment, negative emotion, happiness, loneliness and physical health. Test-retest reliability and construct validity of the sub-scales are acceptable (Butler & Kern, 2016; Sun, Kaufman, & Smillie, 2018).

Pain catastrophizing was measured using the Pain Catastrophizing Scale (PCS, Sullivan, Bishop & Pivik, 1995). The 13-item scale measures overall level of catastrophizing about pain and provides sub-scores on the components of rumination, magnification and helplessness. Studies indicate the measure has satisfactory reliability and adequate concurrent validity when correlated with a measure of

negative thoughts in response to pain, as well as convergent and discriminant validity in a student sample (Osman et al., 1997).

Pain and symptom severity were measured using the Symptom Severity Score (SSS) and Widespread Pain Index (WPI) of the Fibromyalgia Survey Questionnaire (FSQ; Hauser et al., 2012), which is a tool used for diagnosing fibromyalgia. The WPI consists of a 19-item checklist of body parts for marking where pain has occurred in the past week, and the SSS comprises three items asking about symptom severity (fatigue, waking unrefreshed, cognitive symptoms) and an item asking about presence of other physical and psychological symptoms. The measure has good criterion validity when compared against the Fibromyalgia diagnostic criteria.

Health quality of life was measured with the EQ-5D-5L (Health Quality of Life Questionnaire; Herdman et al., 2011). The tool measures five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Participants select their level of difficulty using five options from "no problems" to "extreme problems". Participants also indicate their self-reported health on a visual analogue scale (VAS) from 'the best health you can imagine' to 'the worst health you can imagine'. Convergent validity and test-retest reliability were acceptable within a sample of osteoarthritis patients (Connor-Spady et al., 2015).

Procedure

Flyers and posters advertising the study were placed in waiting rooms of pain clinics, and clinicians also handed flyers to their patients who expressed interest (see Appendix C). Participants either emailed me directly to express interest in the study or their contact details were passed to me by their pain clinician, with their consent.

The study was also advertised via email to DClinPsy trainees at Canterbury Christ Church University, asking them to pass the details on to anyone they knew with chronic pain who might be interested in the mindfulness study.

All participants who expressed interest were emailed an information sheet (see Appendix D) and then contacted the main researcher if they wanted to participate. They were then randomized and emailed a personalized survey link to complete a consent form (see Appendix E) and baseline measures. Those who had been allocated to the intervention then received a link to the MBF program and were instructed to create an account and begin the program immediately. They were encouraged to practice each module for four days before moving onto the next module.

All participants that had completed measures at T1 were contacted via email for follow up questionnaires at time points T2 and T3, regardless of their level of engagement with the program (White, Horton, Carpenter, & Pocock, 2011). Participants in the intervention group were encouraged to continue using the exercises from the MBF program after completing it. On submission of their T3 questionnaires, the control group received a link to access the MBF. All participants who submitted T3 questionnaires were offered the opportunity to enter into a prize draw for one of two £50 vouchers.

Data Analysis

T-tests were used to assess whether there were any differences between the intervention and control groups on the outcome measures at baseline. After checking for violations of assumptions, ANOVA was chosen to analyse the intervention effects on the outcome measures. Significant group by time interactions were further

investigated using post-hoc t-tests. Pearson correlation coefficients were also calculated between all outcome variables at baseline. All analyses were carried out using SPSS v24 (IBM, 2016).

A complete-case (CC) analysis approach was taken. CC analysis only uses observed data, omitting all participants with any missing data from analysis (Salim, Mackinnon, Christensen & Griffiths, 2008). By contrast, the intent-to-treat (ITT) principle (Guyatt and Rennie, 2001) uses all data collected and imputes missing data by various methods. ITT analysis is often recommended in order to measure effectiveness rather than efficacy of treatments, minimizing the potential bias of only including treatment adherers in the analysis. A commonly used approach to ITT is last observation carried forward (LOCF), but there is growing concern about this method, as although it has often been viewed as conservative from a treatment effect perspective, it biased in almost all conditions (Lachin, 2015). Furthermore, in pre-test post-test studies such as the present one, data is being carried forward from only one or two observations. Salim et al., after modelling the bias in different ITT methods for such studies, conclude that LOCF should never be used. They found that, although it does not follow the ITT principle, CC analysis is unbiased or nearly unbiased when intra-individual correlation is high. In the present sample, intra-individual correlation was extremely high when each measure was considered over time, with all correlations being highly significant ($p < 0.0001$, $r > 0.7$; see Appendix L).

Ethical considerations

The study was granted ethical approval from the Research Ethics Committee and Health Research Authority, and was also approved by the research and development offices at the two NHS recruitment sites (see Appendices F to K). The potential risks

to participants included heightened awareness of negative emotional states and possible increased hopelessness if participants did not find the intervention helpful. The participant information sheet made clear that the focus of the intervention was not to reduce pain symptoms and that we could not promise that it would help them. It also advised participants of the risk of heightened emotional states and advised them to contact their clinician, GP or researcher if they had concerns.

Results

Comparisons between CC sample and cases lost to follow-up

The CC sample had higher health quality of life (EQ-5D-5L) than the cases excluded due to missing data at baseline ($t = 3.58$, $p = 0.001$). Aside from this, there were no significant differences between the CC sample and excluded sample on any outcome measure at baseline (see Appendix M). Participants who had previously meditated regularly were more likely to drop out (chi-squared = 4.30, p=0.038), but there were no other differences between the CC sample and excluded group on demographic variables. More participants in the intervention group were lost to follow-up than controls (45% and 25% respectively), but this difference did not reach significance (chi-squared = 1.68, $p = 0.20$). Finally, a Mann-Whitney U test comparing MBF completion among participants in the CC and lost to follow-up (LTFU) intervention groups indicated that those in the CC group completed more of the MBF than those who were lost to follow-up ($p = 0.025$). Therefore previous regular mindfulness practice and MBF completion appeared to be covariates for missing data.

MBF adherence

Figure 2 shows the completion rates of the MBF for the whole intervention group (n=29) and for the CC intervention group (n=16). Among the intervention group as a whole, mean adherence to the MBF was 59% (standard deviation 39%). Six participants (21%) did not access the intervention and ten participants (34%) completed the program. Among the CC group, the mean completion was 78% (standard deviation 28%). Participants also gave feedback post-intervention as to how often they practiced the meditations and exercises. On average, CC participants said that they practiced both meditations and positive psychology exercises (each designed as a ten minute practice) 3-4 times per week.

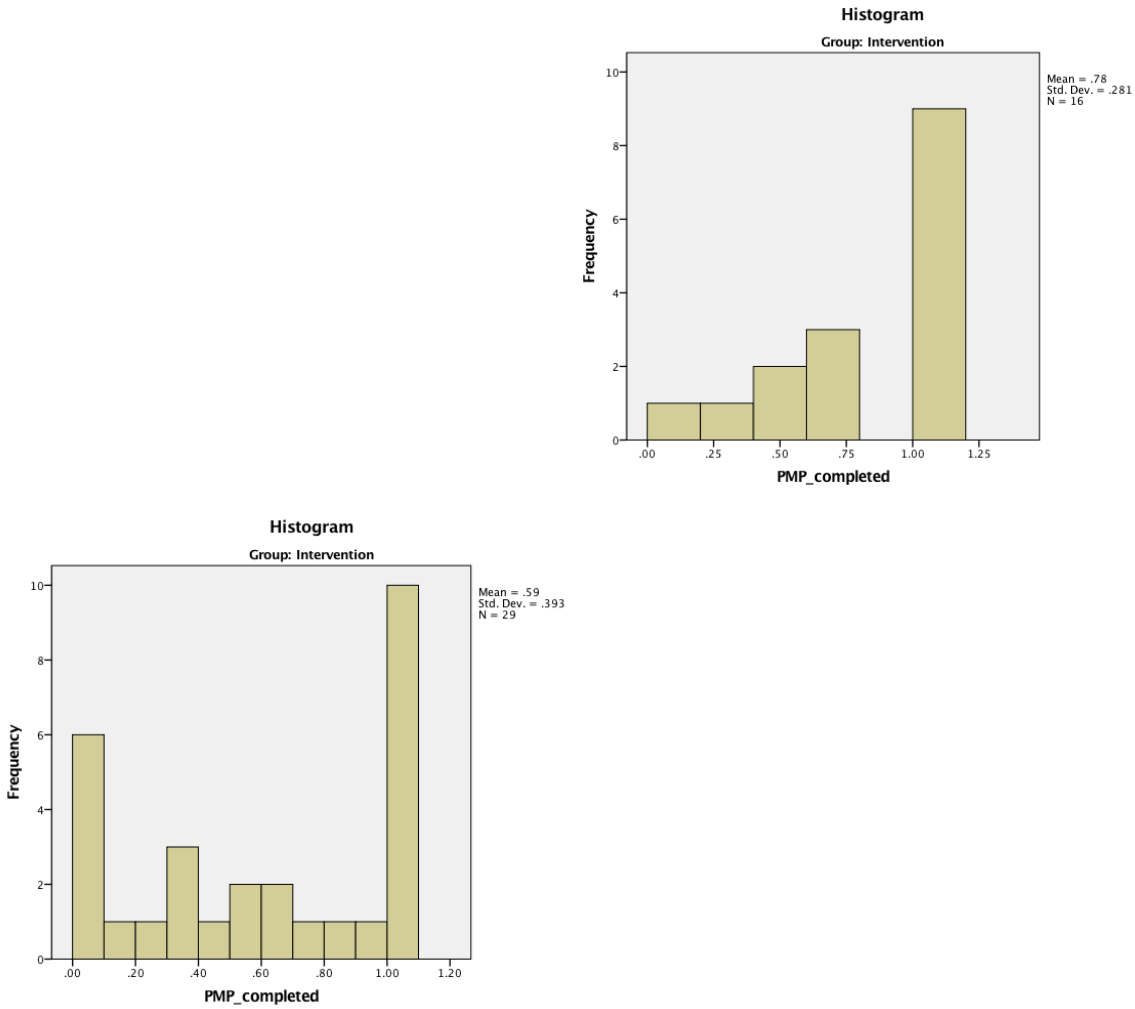

Figure 2. Completion rates of the MBF for the whole and CC intervention group.

There was no significant correlation between MBF adherence and PERMA at baseline in the intervention group (Spearman's Rho = 0.12; $p = 0.54$).

Correlations between baseline measures

Pearson correlation coefficients (r) were examined between all outcome measures at baseline for all participants who provided baseline data, and are presented in Table 3. Strong associations were seen between subjective wellbeing and all of the other variables, as well as between health quality of life, health today and all of the other variables. Widespread pain was the least strongly correlated with the other variables,

but its association still reached significance for all variables aside from mindfulness and pain catastrophising.

Table 3
*Pearson correlation coefficients (*r*) among measures at baseline for all participants (n=48)*

Measure	FMI	PCS	WPI	SSS	PERMA	HQoL
Mindfulness (FMI)	-					
Pain Catastrophising (PCS)	-.301*	-				
Widespread Pain (WPI)	-0.024	0.131	-			
Symptom Severity (SSS)	-0.243	.522**	.501**	-		
Subjective wellbeing (PERMA)	.532**	-.614**	-.316*	-.496**	-	
HQoL (EQ-5D-5L)	-.404**	.524**	.295*	.523**	-.681**	-
Health today (VAS)	.339*	-.517**	-.343*	-.589**	.615**	-.740**

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Main effects and interactions

T-tests were used to check there were no significant differences between the intervention and control groups at baseline (see Appendix N), before using ANOVA to carry out the main analyses. Means, standard deviations, ANOVA interaction results and results from post-hoc t-tests are presented in Table 4. Observed power was below 0.8 for all ANOVAs performed, indicating an insufficient sample size which increases the chance of a type II error.

Table 4

Means and standard deviations of outcome measures for CC intervention and control groups

	Treatment allocation	Baseline Mean (s.d.)	Post intervention mean (s.d.)	Follow-up mean (s.d.)	Time*group interaction (*F* (effect size))	Post hoc t-tests Pre to post (*t*)	Post hoc t-tests Pre to follow up
FMI total	Intervention	33.00 (7.25)	35.38 (6.79)	38.31 (7.50)	4.01* (*d* = 0.76)	1.57	3.05***
	Control	29.00 (5.96)	27.79 (5.99)	29.21 (5.34)		1.57	0.19
PCS total	Intervention	22.06 (13.23)	15.56 (9.91)	15.56 (11.41)	1.75[§] (*d* = 0.5)	3.75**	2.64*
	Control	25.85 (13.43)	24.64 (12.79)	22.14 (12.04)		0.71	1.97
WPI total	Intervention	6.75 (4.84)	7.38 (4.27)	6.69 (4.54)	2.39 (*d* = 0.58)		
	Control	6.14 (4.83)	8.00 (5.46)	7.71 (5.27)			
SSS total	Intervention	6.50 (2.36)	4.25 (1.98)	4.44 (2.42)	0.34 (*d* = 0.22)		
	Control	7.42 (3.25)	5.57 (2.98)	5.57 (2.93)			
PERMA score	Intervention	5.57 (1.31)	6.07 (1.23)	6.51 (1.14)	3.24* (*d* = 0.68)	2.09	4.19***
	Control	4.77 (1.46)	4.72 (1.51)	4.98 (1.57)		0.26	0.90
EQ-5D-5L average score	Intervention	2.28 (0.59)	1.95 (0.67)	1.99 (0.66)	3.47* (*d* = 0.7)	3.99***	3.62**
	Control	2.36 (0.63)	2.40 (0.83)	2.29 (0.75)		0.34	0.65
Health today VAS	Intervention	60.06 (17.83)	63.31 (19.19)	68.25 (19.28)	2.41 (*d* = 0.58)		
	Control	50.93 (15.54)	52.86 (20.87)	48.93 (21.34)			

* significant at $p < 0.05$ ** significant at $p < 0.01$ *** significant at $p < 0.001$

[§] There was a significant effect of time on pain catastrophising so post-hoc analysis was completed.

Mindfulness

The time by group interaction for mindfulness (FMI, see Figure 3) was significant ($F(2,27) = 4.01$, $p = 0.024$) with a large effect size ($d = 0.76$), and there was a significant main effect of time across the whole cohort ($F(2, 27) = 4.96$, $p = 0.01$). Post hoc t-tests indicated that while the increase in the intervention group from T1 to T2 failed to reach significance ($t = 1.57$, $p = 0.14$), by T3 the change from T1 had reached significance ($t = 3.05$, $p = 0.008$). Similar analyses for the control group

showed no significant change in mindfulness at either time point (T2: $t = 1.57$, $p = 0.14$; T3: $t = 0.19$, $p = 0.85$).

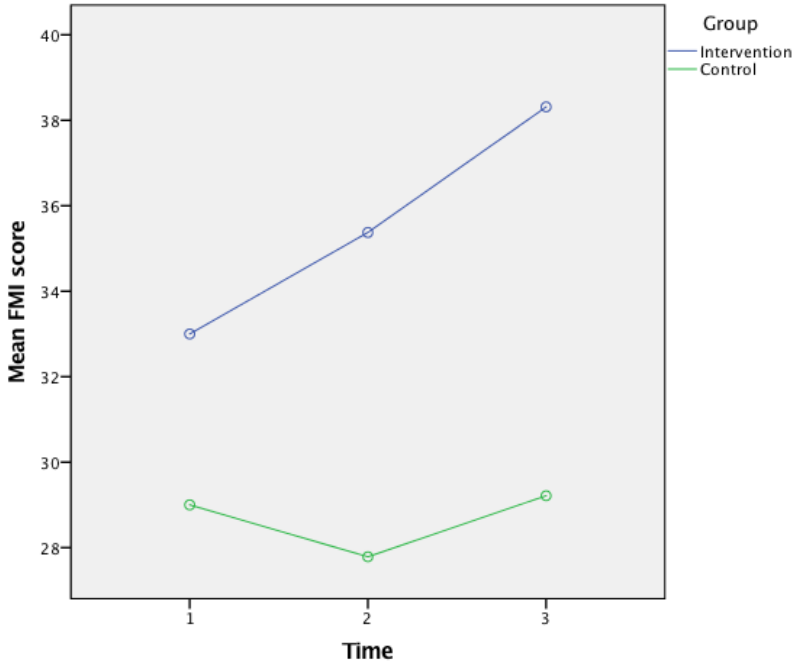

Figure 3. Plot of the time*group interaction for mindfulness.

Subjective wellbeing

The group by time interaction for wellbeing (PERMA, see Figure 4) was significant ($F(2, 27) = 3.24$, $p = 0.047$) with a medium effect size ($d = 0.68$), and the main effect of time was significant across the whole CC sample ($F(2, 27) = 7.34$, $p = 0.001$). Post hoc t-tests indicated that the increase in PERMA from T1 to T2 approached significance for the intervention group ($t = 2.09$, $p = 0.054$) and from T1 to T3 reached significance ($t = 4.19$, $p = 0.001$) but did not change significantly over time for the control group at either time point (T2: $t = 0.26$, $p = 0.80$; T3: $t = 0.90$, $p = 0.39$).

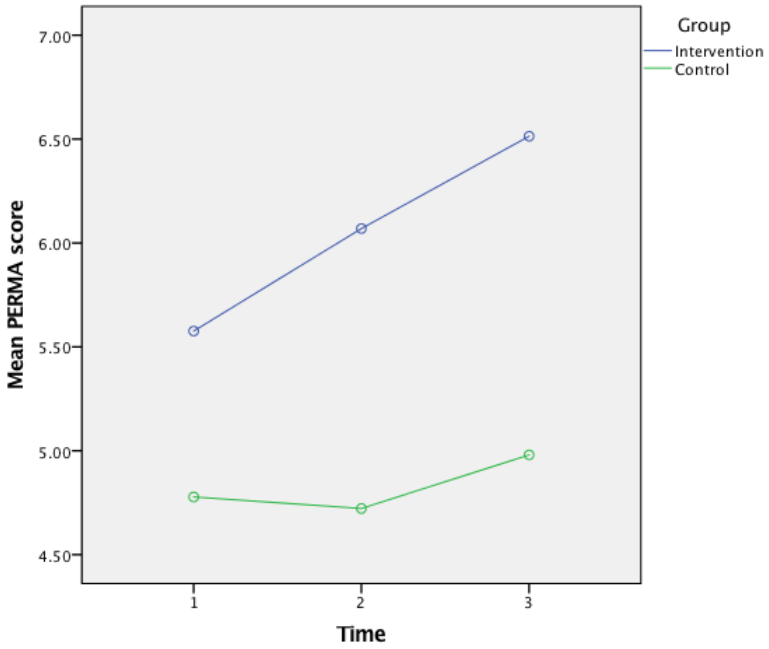

Figure 4. Plot of the time*group interaction for wellbeing.

Pain catastrophising

There was no significant group by time interaction ($F(2, 27) = 1.75$, $p = 0.18$), although there was a significant main effect of time on pain catastrophising (PCS, see Figure 5) ($F(2, 27) = 7.11$, $p = 0.002$). Post hoc t-tests revealed a significant reduction in pain catastrophising from T1 to T2 and from T1 to T3 in the intervention group (T2: $t = 3.75$, $p = 0.002$; T3: $t = 2.64$, $p = 0.018$). There was no significant reduction in pain catastrophising for the control group from T1 to either T2 or T3 (T2: $t = 0.71$, $p = 0.49$; T3: $t = 1.97$, $p = 0.070$).

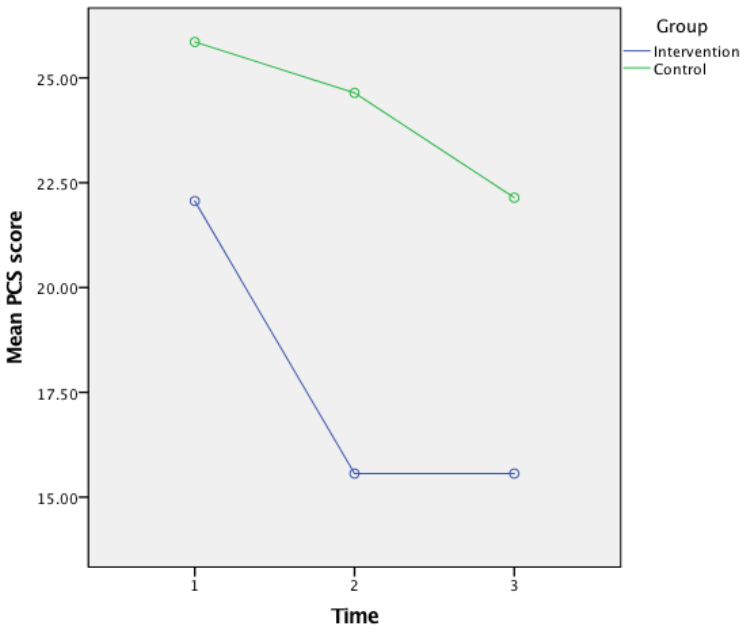

Figure 5. Plot of the time*group interaction for pain catastrophising.

Health quality of life

There was a significant time by group interaction for health quality of life (EQ-5D-5L, see Figure 6) ($F(2, 27) = 3.47$, $p = 0.038$) with a medium to large effect size ($d = 0.7$). The intervention group showed significant improvement (as indicated by falling scores) from baseline to post intervention ($t = 3.99$, $p = 0.001$) and from baseline to follow up ($t = 3.62$, $p = 0.003$). No such improvements were seen in the control group (T2: $t = 0.34$, $p = 0.74$; T3: $t = 0.65$, $p = 0.53$).

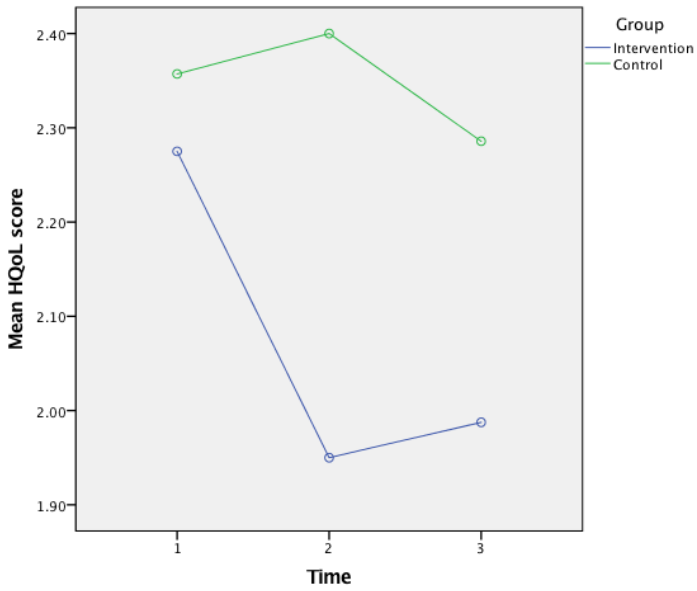

Figure 6. Plot of the time*group interaction for health quality of life (note that lower scores represent better health quality of life).

The 'health today' VAS component of the EQ-5D-5L was analysed separately.

Although a trend can be seen in Figure 7 for health of the intervention group to increase over time and the control group to remain fairly constant, this interaction was not significant ($F(2,27) = 2.42$, $p = 0.099$).

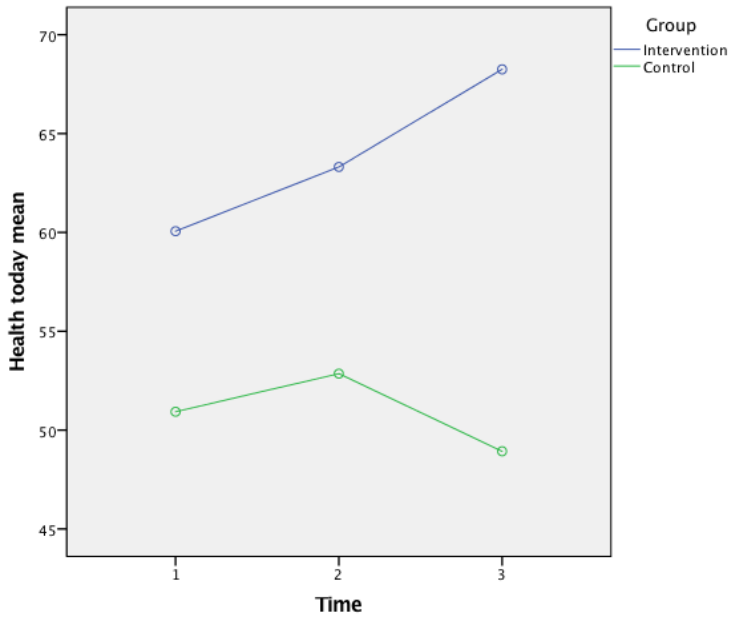

Figure 7. Plot of the time*group interaction for the 'health today' component of the EQ-5D-5L.

Pain

Symptom severity

There was no significant time by group interaction for levels of symptom severity (SSS) ($F(2,27) = 0.29$, $p = 0.72$). There was a highly significant effect of time ($F(2,27) = 46.91$, $p < 0.001$). The plot in Figure 8 reveals that a very similar pattern of reduction in symptom severity from baseline to post intervention is seen for both groups, which was maintained to follow-up.

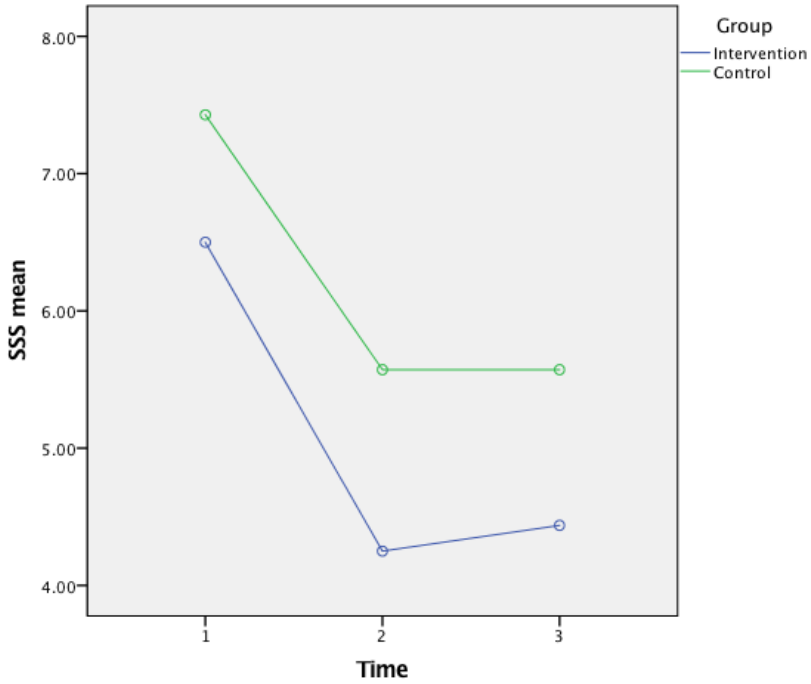

Figure 8. Plot showing the main effect of time for SSS in both groups.

Widespread pain

There was no significant group by time interaction effect for widespread pain (WPI) ($F(2,27) = 2.39$, $p = 0.10$), although a significant main effect of time was seen ($F(2,27) = 5.16$, $p = 0.009$). Looking at the plot in Figure 9, there is an increase in widespread pain for both groups from T1 to T2, especially the control group, followed by a slight reduction at T3.

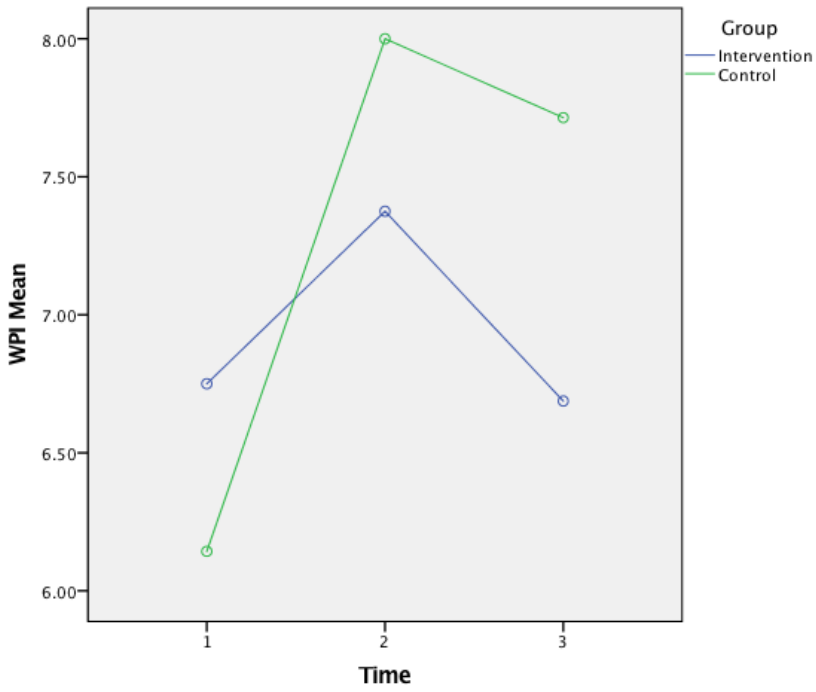

Figure 9. Plot showing the main effect of time for WPI in both groups.

Comments from participants

Participants in the intervention group were provided the opportunity in the post-intervention questionnaire to comment on their experience of the mindfulness program. Table 5 lists quotes from their feedback, grouped according to themes that emerged from the data using an inductive thematic analysis method (Braun & Clarke, 2006). Some of the comments aligned with the improvements in subjective wellbeing seen in the quantitative data, such as feeling positive affect and developing a deeper sense of meaning. In line with the reductions in symptom severity seen in the quantitative data, some participants attributed pain relief to the relaxation experienced through meditation.

It was clear from the participant comments that there were both logistical and personal challenges in carrying out the daily meditations and activities. Some

participants found the activities or meditations emotionally difficult, perhaps because they heightened awareness of negative thoughts and feelings. Others found the content or style unconvincing or not a good fit for them.

Table 5

Intervention group participants' experiences of the MBF

Theme	Quotes
Meaning	"I am finding the mindfulness topics very helpful. It helps me to stop and think harder not just take everyone/thing for granted." "It's helping me think about things more" "Opened my mind to new things" "It gave me time to think."
Positive affect	"Positive and calming" "It has helped me to relax more and focus and also help me with my mind wondering." "I enjoyed the meditation" "Enjoyed the concept and the activity" "It was really interesting and useful in many ways."
Self-awareness	"The first meditation surprised me, I did not expect to pick up on emotions when scanning my body. My heart felt thickened and working hard, my lungs showed sadness"
Release from pain and negative affect	"I have found the daily meditation exercises really helpful in terms of lessening the amount of anxiety I have been experiencing, as well as the resulting chronic headaches" "The meditation was relaxing which helped ease pain" "Encourages [me] to bear the pain and relax" "I found it very useful to take myself away from negative mind talk and bring myself back to a quiet mind"
Fitting it into daily life	"I forgot to do the meditation once and remembered when I was in bed but did not want to get up to do it then." "I need more time in the day/week/year to finish the course" "Really good but sometimes found it difficult to do every day due to work." "I have been away, also in hospital briefly" "Difficult because of the school holidays"
Emotional and personal challenges	"I did give it a go, though, and it was still interesting, but I noticed my thoughts often coming back to negative things, like 'I am useless'." "[The] daily activity was 'too painful' emotionally. Almost need to do the course twice to get confidence to write things down as well as think them in the meditation" "[I] found the meditation hard"

	"There were some practices I struggled to engage with... Particularly those related to self-compassion and stuff. It felt unnatural for me" "I did not find all the content convincing" "I don't know why, now I am finding [the] program very difficult to do, I am finding [it] hard to do meditation or any activities"
Lack of fit of the intervention to the person	"It really doesn't work for me but helped me indirectly by reminding me about meditation and having found it helpful in the past." "Did not feel that targeted to me" "I'm not in the mood for meditation right now"

One participant's wife also did the course with him, and said that she "really enjoyed it" and "got so much out of it". She said that before starting the course she was "close to breaking" due to her husband's pain condition and that the MBF helped her to cope.

Discussion

This was the first time that an MBI specifically aimed at improving subjective wellbeing was trialled among participants with chronic pain. The first finding was that mindfulness improved for those in the MBF group from baseline to follow-up relative to waitlist controls. Given the mindfulness focus of the MBF, this is unsurprising, but supports previous research that the MBF increases mindfulness in a general population sample (Ivtzan et al., 2016; Ivtzan et al., 2017). The results improve on the variable effects on mindfulness seen in other computerised MBIs for people with chronic pain (e.g. Dowd et al., 2015; Trompetter, Bohlmeijer, Veehof & Schreurs, 2015). The finding offers the possibility that increased mindfulness might have mediated improvements seen in other variables, as theorised by Day, Jensen, Ehde and Thorn (2014) in their 'model of the mechanisms of MBIs for chronic pain management'.

The second key finding is that, as expected, the MBF improved subjective wellbeing among those receiving the intervention. We conjectured that combining mindfulness with positive psychology, such that the intention of the MBI was to improve wellbeing, might enhance the effects of mindfulness practice on wellbeing. The effect size of the improvement in subjective wellbeing (d=0.68) does indeed surpass those seen in other computerised MBIs for chronic pain (Davis & Zautra, 2013; Dowd et al., 2015) as well as those of PPIs in general population samples (Bolier et al. 2013). This suggests there is potential additional benefit in combining mindfulness and PPIs. The finding also builds on the newly emerging evidence for the benefits of PPIs for wellbeing and supports their potential for further use in the field of chronic pain.

The improvement in wellbeing was reflected in comments from participants that they enjoyed the MBF, found it relaxing and that it enhanced gratitude. The ability of the MBF to improve subjective wellbeing despite pain is an important finding. Firstly, it provides hope that a higher level of subjective wellbeing is achievable among a group whose wellbeing is often severely compromised (Price, 2012). Secondly, aside from the intrinsic value of higher wellbeing, it is promising because positive affect provides respite from pain and boosts recovery, and eudaimonic wellbeing may represent a shift in focus away from pain and distress towards living a meaningful and valued life (Ong et al., 2015).

In the present study, subjective wellbeing and mindfulness both continued to improve to follow-up among the intervention group, with the increase only reaching statistical significance at follow-up. Enduring benefits are a common finding in MBIs for chronic pain, which Veehof et al. (2016) attribute to participants continuing to apply

mindfulness principles after treatment. In the present study, where the MBF remained available indefinitely, it may also indicate that participants continued to engage with the positive psychology and mindfulness exercises for longer than four weeks, as they were encouraged to do. This would align with a meta-analysis finding that PPIs should be delivered for at least four weeks, but that effects improved for interventions that lasted 8 weeks or longer (Boiler et al., 2013). Another possibility is that the MBF facilitated a shift in outlook and approach to life, as has been observed among participants with chronic pain in qualitative MBI studies (Morone, Greco & Weiner, 2008; Van Gordon et al., 2016).

This was the first time a PPI trial for chronic pain explicitly measured health quality of life. Health quality of life as measured in the present study comprised mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Although it was strongly correlated with subjective wellbeing in our sample, the focus of health quality of life is on deficits rather than positive states. Some of the participant comments focused on deficit reduction, such as feeling less anxious and moving away from negative thoughts. The medium to large beneficial effect on these factors mirrors Ivtzan et al.'s (2016) finding that the MBF reduced depression. The findings of the present study also align with meta-analytic findings that MBIs improve quality of life for people with chronic pain (Veehof et al., 2016), albeit the effect size is larger in the present study, perhaps suggesting an additional benefit from including the PPIs.

Although the MBF did not directly target pain catastrophising, the intervention group reported a reduction in this variable over the course of the study. Pain catastrophising is "an exaggerated negative mental set brought to bear during actual or anticipated

painful experience" (Sullivan et al., 2001, p.52). Just as MBIs with an intention of reducing symptoms can have 'side effects' of increasing positive variables such as happiness, this MBI with a positive intention reduced negative variables. Such an effect was also achieved in Muller et al.'s (2016) PPI feasibility trial, which saw reductions in pain catastrophising and other pain variables for participants with chronic pain, despite no pain-focused intervention.

Studies in chronic pain frequently report reductions in pain catastrophising following MBIs (e.g. Cusens et al., 2010; Turner et al., 2016). One possibility is that the increase in mindfulness reduced levels of pain catastrophising; Schütze, Rees, Preece and Schütze (2010) found that mindfulness uniquely predicted pain catastrophising among a number of relevant variables in regression analysis. However, more recent research (Day, Smitherman, Ward & Thorn, 2015) found that worry explained much of the association between mindfulness and pain catastrophising, which was not measured in the present study. Considering the topics included in the MBF alongside the elements of pain catastrophising, it is possible that training in self-awareness, engagement and self-compassion targeted the rumination aspect of catastrophising, and training in autonomy could have improved the helplessness component.

As expected, no improvement in widespread pain was seen in the study, mirroring others that have equally found no impact of mindfulness or PPIs on pain itself (e.g. Davis & Zautra, 2013; Dowd et al., 2015; Peters et al., 2017). In fact, widespread pain appeared to increase from baseline to post-intervention for both groups, perhaps reflecting a greater awareness of pain in different areas of the body brought on by answering questions about it.

There was no specific benefit of the MBF on symptom severity. Both the intervention and control groups benefitted from an initial reduction in SSS following entry into the study, possibly indicating an effect of simply being in a clinical trial, anticipating improvement or observing oneself (Braunholtz, Edwards & Lilford, 2001). Another possible explanation for the reduction in symptom severity for both groups is that, given that chronic pain often involves 'flare ups', there may be an over representation of people who are having flare ups at the time of entry to the study. During a flare up, people may be more willing to try a research study, and then over the course of the study the flare up settles.

Strong correlations were seen between almost all variables measured in the study. This could reflect common underlying factors, covariance, causal links, or related concepts. The links between subjective wellbeing and mindfulness are well documented (e.g. Brown & Ryan, 2003) and mindfulness to meaning theory (Garland et al., 2015) suggests a causal link, whereby increased mindfulness leads to increased subjective wellbeing in a virtuous spiral. Equally, the correlations seen in the present study are consistent with the strong evidence for an association between chronic pain and poorer subjective wellbeing and quality of life (e.g. Gureje, Von Korff, Simon & Gater, 1998; Price, 2012).

It was clear from the comments received by participants that, for some, there were significant emotional challenges involved in using the MBF. Similar challenges, such as developing awareness of physical and emotional pain during the self-awareness module, are described by Perridge, Hefferon, Lomas and Ivtzan (2017) in their

qualitative analysis of participants' responses to the MBF. These difficulties are not necessarily problematic for the MBF, or even for those individuals suffering them. The second wave of positive psychology emphasises the importance of embracing 'negative' experiences along with the 'positive', recognising that uncomfortable and difficult experiences also carry the potential for growth (Ivtzan et al., 2015). Such growth was evident from the model Perridge et al. developed from their data, in which the initial "challenge of emerging awareness" was followed by "a sense of something profound that's been gained" (p.10).

Practical difficulties were also evident from participants' comments, especially fitting it into busy lives and motivating oneself to practice. Such challenges are inherent in self-directed interventions (Eysenbach, 2005) and clearly the online delivery has both benefits and drawbacks. The increasing ubiquity of technology makes computerised interventions more feasible and accessible for a broad range of people. For people who experience chronic pain, mobility may be compromised and therefore an intervention that can be completed in the comfort of one's own home is potentially appealing. Furthermore, in the current climate of financial strain on the NHS, it is appealing that the MBF requires very little resource to run. However, if the MBF was conducted in a group, or if participants had a way of discussing their experiences with each other, it may be easier to accept and overcome some of the challenges of the program and to commit to regular practice.

Strengths and limitations

External validity for this study was enhanced by the context: people were able to do the program in the way it could be used outside of a formal clinical trial. The diversity

in terms of age, source of pain and educational background also promotes the generalizability of the results. However, data on participants' ethnicity and employment were not gathered and, as with many research studies using MBIs for chronic pain, women outnumbered men.

Due to resource limitations and the main researcher not being directly involved in recruitment, we were unable to achieve the sample size required by the a priori power calculations. High attrition rates reduced the sample size even further. Therefore, the number of participants in the CC group fell short of the calculated required number to test the hypotheses. This raises the possibility that some of the non-significant trends seen, such as for mindfulness and subjective wellbeing to improve from baseline to post-intervention, would have reached significance with a larger sample size.

The attrition rate in the present study is comparable to that seen in other internet-delivered MBIs (e.g. Dowd et al., 2015) and to a trial of the MBF in a general population sample (Ivtzan et al., 2016). The high attrition rate disproportionately affected the intervention group. Fortunately this unequal pattern was predicted and counteracted by over-selecting for the intervention group at the study start so that final intervention and control groups were roughly equal in size. However, high attrition rates run a risk of biased results due to potentially systematic differences between those lost to follow-up and those who remained in the study. Although there were no significant differences in the outcome variables, two other significant differences were indeed found between participants who completed all measures and those who were lost to follow up. As depression and anxiety were not measured, it is unknown whether those with higher levels of emotional distress were more likely to

drop out, a pattern that has been observed in studies measuring adherence to internet interventions (Christensen, Griffiths & Farrer, 2009).

Firstly, significantly more meditators were lost to follow-up. It was interesting that those participants who had past experience of regular mindfulness practice were more likely to drop out than those who did not. While the very small number of people to whom this applied limits what can be said, it may be that people who are familiar with mindfulness have less hope of potential benefits as they are not trying something new. Or they may have or know where to find resources for practicing mindfulness themselves and therefore have less need for the program. For example, one participant said that she did not like the MBF but that it prompted her to reengage with the mindfulness practice she had done in the past.

Secondly, among the intervention group, failure to complete post-intervention and follow-up measures was strongly associated with lower engagement with the MBF. Those who did not provide outcome data may not have found the MBF helpful, or may have simply had lower motivation or ability to engage with the study generally. In such cases, it is likely their outcomes would have shown less improvement than the participants who did engage with the MBF. Previous research on MBIs (including for chronic pain) has found that improvements in wellbeing and mindfulness were correlated with amount of home practice (Carmody & Baer, 2008, Rosenzweig et al., 2010). Interestingly though, Lyubomirsky and Della Porta (2012) found that completing positive psychology exercises weekly raised subjective wellbeing as much as performing them several times per week.

The average adherence rate of 59% among the whole intervention group was higher than reported in other online MBIs (Buhrman et al., 2013; Trompetter et al., 2015). Face-to-face mindfulness interventions tend to have better adherence (Mohr et al., 2010), perhaps highlighting the benefit of having a social element to the course. In support of this, one online CBT course (Dear et al., 2013) achieved a 90% adherence rate by calling participants weekly, and research suggests that mindfulness may be more effective when on-going support mechanisms are in place (Pradhan et al., 2007). This was not feasible in the current study due to limited resources, but aiming for very high adherence may not be necessary or appropriate. Eysenbach (2005) criticised traditional viewpoints that high dropout rates undermine trials, positing that high dropout rates be considered a "natural and typical feature" (e.11) of self-help programs. Certainly persuading people to continue an intervention they are not finding helpful, or may even be finding harmful, would go against the British Psychological Society's principle of respect (BPS, 2009).

A further limitation was the use of a waitlist control with no placebo intervention. Because of this, we cannot rule out the possibility of non-specific intervention effects influencing or being responsible for the improvements seen in outcome variables. Participants receiving the MBF may have had expectations or hopes of improvement simply due to the knowledge they were receiving a treatment (Miller & Rosenstein, 2006) or the act of engaging in a structured program may have activated change.

Finally, baseline data were collected after randomisation, which could have biased the baseline responses. However, there were no significant differences between the

intervention and control groups at this time point. The one-month follow-up time for this study was also too short to assess any lasting change.

Clinical implications

The use of the MBF for people suffering with chronic pain addresses calls for a 'positive health' approach to pain management (Buchbinder et al., 2018). Although this was a small study, it showed promising potential for the MBF to improve subjective wellbeing and health quality of life for people experiencing chronic pain. Its low dissemination cost could make it a feasible option for pain services and GPs to offer people experiencing chronic pain who are open to the concept of positive health. However, although it is cheaper than face-to-face interventions, the MBF still costs between £10-£60 per user[3].

Given the very high levels of attrition in the intervention group, and some of the feedback from participants who felt it was not tailored to them, the MBF is not a universally appropriate or beneficial intervention. One option for use could be to offer service users a short trial period to decide whether they want to persist with the program. Telephone support or an online chat forum could be provided to assist and encourage participants to complete the intervention, as similar RCTs doing this had lower attrition rates than the present study (e.g. Peters et al., 2017).

[3] The cost depends on the number of users the intervention is bought for: 1user costs £60, 2-100 users costs £50 per user, 101-500 users costs £40 each, 501-1000 users costs £30 each, 1001-5000 users £20 each and 5000+ users costs £10 each.

The experience of the wife of one of the participants highlights the challenge of supporting a partner with chronic pain. Negative effects of caring on wellbeing have been documented elsewhere (e.g. Cummins, 2001). Programs aimed at improving wellbeing could also be offered to those who care for the person with chronic pain, and in fact involving family members in interventions for people with chronic illness has been shown to improve outcomes for the patients themselves (Martire, Lustig, Schulz, Miller & Helgeson, 2004). While providing interventions for additional people could prove a funding challenge for cash-strapped services, an online program such as the MBF would be lower cost than face-to-face interventions to extend to others.

Research implications

This study warrants replicating in order to address some of its limitations, ideally using three treatment conditions: the MBF, a placebo intervention and a waitlist control. The study should seek to recruit a large enough sample to increase the power of the statistical tests to above 0.8. To adhere to best practice, it should also employ an intent-to-treat analysis using a multiple imputation or maximum likelihood method as recommended by Salim et al. (2008). Longer follow-up times, such as six months and a year, would also strengthen the study.

High attrition and failure to complete the full MBF were issues in the intervention group in this study. Future studies could try to pre-emptively address these issues by building in support mechanisms such as weekly phone calls to participants or online chat forums. They could also clearly set out expectations for adherence at the start of

the study, particularly with regard to completing outcome measures. This would need to be done sensitively, with awareness of the BPS ethical principles.

The present study found that the MBF increased levels of mindfulness among participants. However, the design did not allow for testing whether mindfulness mediated any of the other effects. For example, although it was not designed for use with people with chronic pain, the MBF had beneficial effects on pain catastrophising and health quality of life. McCracken and Vowles (2014) highlighted the lack of research on processes of change through mindfulness. Further research into the mechanisms by which the MBF improves wellbeing, health quality of life and pain catastrophising would be interesting and useful to help develop more targeted interventions.

This study measured wellbeing using the PERMA tool (Butler & Kern, 2016), which was specifically designed for measuring subjective wellbeing. The improvement seen in the intervention group suggests that it was a meaningful and useful instrument for this type of study. Studies investigating effects of chronic pain interventions should consider measuring subjective wellbeing alongside deficit-focused measures such as health quality of life, anxiety and depression.

Conclusion

The results of this randomised controlled trial indicate that the MBF has potential for use as an intervention for improving subjective wellbeing among people experiencing chronic pain. Due to some limitations, including high attrition and the study being underpowered, replication is recommended to strengthen the findings.

References

Bergsma, A., Have, M. ten, Veenhoven, R., & Graaf, R. de. (2011). Most people with mental disorders are happy: A 3-year follow-up in the Dutch general population. *The Journal of Positive Psychology*, *6*(4), 253–259. doi:10.1080/17439760.2011.577086

Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: a meta-analysis of randomized controlled studies. *BMC public health*, *13*(1), 119. doi:10.1186/1471-2458-13-119

Braun, V. and V. Clarke (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. doi:10.1191/1478088706qp063oa

Braunholtz, D. A., Edwards, S. J. L., & Lilford, R. J. (2001). Are randomized clinical trials good for us (in the short term)? Evidence for a "trial effect." *Journal of Clinical Epidemiology*, *54*(3), 217–224. doi:10.1016/s0895-4356(00)00305-x

British Psychological Society (2009, August). *Code of ethics and conduct.* Retrieved from https://www.bps.org.uk/sites/beta.bps.org.uk/files/Policy%20-%20Files/Code%20of%20Ethics%20and%20Conduct%20(2009).pdf

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*(4), 822. doi:10.1037/0022-3514.84.4.822

Buchbinder, R., van Tulder, M., Öberg, B., Costa, L. M., Woolf, A., Schoene, M., … Woolf, A. (2018, March 21). Low back pain: a call for action. *The Lancet.* doi:10.1016/s0140-6736(18)30488-4

Buhrman, M., Skoglund, A., Husell, J., Bergström, K., Gordh, T., Hursti, T., ... & Andersson, G. (2013). Guided internet-delivered acceptance and commitment therapy for chronic pain patients: a randomized controlled trial. *Behaviour research and therapy*, *51*(6), 307-315. doi:10.1016/j.brat.2013.02.010

Butler, J., & Kern, M. L. (2016). The PERMA-Profiler: A brief multidimensional measure of flourishing. *International Journal of Wellbeing, 6*(3), 1–48. doi:10.5502/ijw.v6i3.526

Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, *31*, 23–33. doi:10.1007/s10865-007-9130-7

Cartagena Farias, J., Porter, L., McManus, S., Strang, J., Hickman, M., Reed, K. & Smith, N. (2017). *Prescribing patterns in dependence forming medicines*. London: NatCen. Retrieved from http://phrc.lshtm.ac.uk/papers/PHRC_014_Final_Report.pdf

Centers for Disease Control and Prevention (2016, May 31). *Well-being concepts*. Retrieved from https://www.cdc.gov/hrqol/wellbeing.htm#eight

Chiesa, A., & Serretti, A. (2011). Mindfulness-based interventions for chronic pain: a systematic review of the evidence. *The Journal of Alternative and Complementary Medicine, 17*(1), 83-93. doi:10.1089/acm.2009.0546

Christensen, H., Griffiths, K. M., & Farrer, L. (2009). Adherence in internet interventions for anxiety and depression: systematic review. *Journal of medical Internet research, 11*(2), e13. doi:10.2196/jmir.1194

Cohen, J. (1992). A power primer. *Psychological bulletin, 112*(1), 155. doi:10.1037/0033-2909.112.1.155

Conner-Spady, B. L., Marshall, D. A., Bohm, E., Dunbar, M. J., Loucks, L., Khudairy, A. A., & Noseworthy, T. W. (2015). Reliability and validity of the EQ-5D-5L compared to the EQ5D-3L in patients with osteoarthritis referred for hip and knee replacement. *Quality of Life Research, 24*(7), 1775–1784. doi:10.1007/s11136-014-0910-6

Cummins, R. A. (2001). The subjective well-being of people caring for a family member with a severe disability at home: a review. *Journal of Intellectual & Developmental Disability, 26*(1), 83–100. doi:10.1080/13668250020032787

Cusens, B., Duggan, G. B., Thorne, K., & Burch, V. (2010). Evaluation of the Breathworks mindfulness-based pain management programme: effects on well-being and multiple measures of mindfulness. *Clinical Psychology & Psychotherapy, 17*, 63-78. doi:10.1002/cpp.653

Davis, M. C., & Zautra, A. J. (2013). An online mindfulness intervention targeting socioemotional regulation in fibromyalgia: results of a randomized controlled trial. *Annals of Behavioral Medicine, 46*(3), 273–284. doi:10.1007/s12160-013-9513-7

Davis, M. C., Zautra, A. J., & Smith, B. (2004). Chronic pain, stress, and the dynamics of affective differentiation. *Journal of Personality*, *72*(6), 1133–1159. http://doi.org/10.1111/j.1467-6494.2004.00293.x

Day, M. A., Jensen, M. P., Ehde, D. M., & Thorn, B. E. (2014). Toward a theoretical model for mindfulness-based pain management. *The Journal of Pain*, *15*(7), 691-703. doi:10.1016/j.jpain.2014.03.003

Day, M. A., Smitherman, A., Ward, L. C., & Thorn, B. E. (2015). An investigation of the associations between measures of mindfulness and pain catastrophizing. *The Clinical journal of pain*, *31*(3), 222-228. doi: 10.1097/AJP.0000000000000102

Dear, B. F., Titov, N., Perry, K. N., Johnston, L., Wootton, B. M., Terides, M. D., ... & Hudson, J. L. (2013). The Pain Course: a randomised controlled trial of a clinician-guided Internet-delivered cognitive behaviour therapy program for managing chronic pain and emotional well-being. *PAIN®*, *154*(6), 942-950. https://doi.org/10.1016/j.pain.2013.03.005

Diener, E., Oishi, S., & Lucas,R. E. (2002). Subjective well-being: The science of happiness and life satisfaction. In C.R. Snyder & S.J. Lopez (Ed.), *Handbook of Positive Psychology*. Oxford and New York : Oxford University Press.

Dowd, H., Hogan, M. J., McGuire, B. E., Davis, M. C., Sarma, K. M., Fish, R. A., & Zautra, A. J. (2015). Comparison of an online mindfulness-based cognitive therapy intervention with online pain management psychoeducation: a randomized controlled study. *The Clinical Journal of Pain*, *31*(6), 517-527. doi:10.1097/ajp.0000000000000201

Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research*, 7, e11. doi:10.2196/jmir.7.1.e11

Fayaz, A., Croft, P., Langford, R. M., Donaldson, L. J., & Jones, G. T. (2016). Prevalence of chronic pain in the UK: a systematic review and meta-analysis of population studies. *BMJ Open*, *6*(6), e010364. doi:10.1136/bmjopen-2015-010364

Garland, E. L., Farb, N. A., Goldin, P. R., & Fredrickson, B. L. (2015). The mindfulness-to-meaning theory: extensions, applications, and challenges at the attention–appraisal–emotion interface. *Psychological Inquiry*, *26*(4), 377-387. doi:10.1080/1047840x.2015.1092493

Geschwind, N., Peeters, F., Drukker, M., van Os, J., & Wichers, M. (2011). Mindfulness training increases momentary positive emotions and reward experience in adults vulnerable to depression: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 79*(5), 618–628. doi:10.1037/a0024595

Goleman, D. (2006). *Social intelligence: The new science of human relationships*. New York: Bantam.

Graham, J.W. & Donaldson, S.I., (1993). Evaluating interventions with differential attritions: the importance of nonresponse mechanisms and use of follow-up data. *Journal of Applied Psychology, 78*(1), 119–128. doi:10.1037/0021-9010.78.1.119

Grossman, P., Tiefenthaler-Gilmer, U., Raysz, A., & Kesper, U. (2007). Mindfulness training as an intervention for fibromyalgia: evidence of postintervention and 3-year follow-up benefits in well-being. *Psychotherapy and Psychosomatics*, *76*(4), 226. DOI: 10.1159/000101501

Gureje, O., Von Korff, M., Simon, G. E., & Gater, R. (1998). Persistent pain and well-being: a World Health Organization study in primary care. *Jama*, *280*(2), 147-151. doi:10.1001/jama.280.2.147

Guyatt, G.H., Rennie, D., 2001. *Users' Guide to the Medical Literature: a Manual for Evidence-Based Clinical Practice*. AMA, Chicago.

Häuser, W., Jung, E., Erbslöh-Möller, B., Gesmann, M., Kühn-Becker, H., Petermann, F., ... & Wolfe, F. (2012). Validation of the Fibromyalgia Survey Questionnaire within a cross-sectional survey. *PLoS One*, *7*(5), e37504. https://doi.org/10.1371/journal.pone.0037504

Herdman, M., Gudex, C., Lloyd, A., Janssen, M. F., Kind, P., Parkin, D., ... & Badia, X. (2011). Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of life research*, *20*(10), 1727-1736. https://doi.org/10.1007/s11136-011-9903-x

Hutcherson, C. A., Seppala, E. M., & Gross, J. J. (2008). Loving-kindness meditation increases social connectedness. *Emotion*, *8*(5), 720. doi:10.1037/a0013237

IBM Corp. Released 2016. *IBM SPSS Statistics for Macintosh, Version 24.0*. Armonk, NY: IBM Corp.

Ivtzan, I., Lomas, T., Worth, P., and Hefferon, K. (2015). *Second Wave Positive Psychology: Embracing the Dark Side of Life*. Routledge.

Ivtzan, I., Young, T., Martman, J., Jeffrey, A., Lomas, T., Hart, R., et al. (2016). Integrating mindfulness into positive psychology: A randomised controlled trial of an online positive mindfulness program. *Mindfulness*, *7*(6), 1396–1407. doi:10.1007/s12671-016-0581-1

Ivtzan, I., Young, T., Lee, H. C., Lomas, T., Daukantaitė, D., & Kjell, O. N. (2017). Mindfulness Based Flourishing Program: A Cross-Cultural Study of Hong Kong Chinese and British Participants. *Journal of Happiness Studies*, 1-19. DOI 10.1007/s10902-017-9919-1

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry, 4*(1), 33–47. https://doi.org/10.1016/0163-8343(82)90026-3

Krusche, A., Cyhlarova, E., King, S., & Williams, J. M. G. (2012). Mindfulness online: a preliminary evaluation of the feasibility of a web-based mindfulness course and the impact on stress. *British Medical Journal open*, *2*(3), e000803. doi:10.1136/bmjopen-2011-000803

Lachin, J. M. (2015). Fallacies of last observation carried forward analyses. *Clinical Trials: Journal of the Society for Clinical Trials, 13*(2), 161–168. doi:10.1177/1740774515602688

Leiberg, S., Klimecki, O., & Singer, T. (2011). Short-term compassion training increases prosocial behavior in a newly developed prosocial game. *PloS one*, *6*(3), e17798. doi:10.1371/journal.pone.0017798

Little, R. & Yau, L., (1995). Intent-to-treat analysis for longitudinal studies with drop-outs. *Biometrics, 52,* 1324–1333. https://doi.org/10.2307/2532847

.

Lyubomirsky S. & Della Porta M. (2012). Boosting happiness, buttressing resilience: results from cognitive and behavioral interventions. In: Reich JW, Zautra AJ, Hall J, (Eds). *Handbook of Adult Resilience: Concepts, Methods, and Applications* (pp.450–464). New York: Guilford Press.

Martire, L. M., Lustig, A. P., Schulz, R., Miller, G. E., & Helgeson, V. S. (2004). Is it beneficial to involve a family member? A meta-analysis of psychosocial interventions for chronic illness. *Health Psychology, 23*(6), 599-611. DOI: 10.1037/0278-6133.23.6.599

McCracken, L. M., & Vowles, K. E. (2014). Acceptance and commitment therapy and mindfulness for chronic pain: model, process, and progress. *American Psychologist*, *69*(2), 178. doi:10.1037/e558122009-002

Miller, F. G., & Rosenstein, D. L. (2006). The nature and power of the placebo effect. *Journal of Clinical Epidemiology*, *59*(4), 331–335. doi:10.1016/j.jclinepi.2005.12.001

Mohr, P., Bitter, I., Švestka, J., Seifritz, E., Karamustafalioglu, O., Koponen, H., & Sartorius, N. (2010). Management of depression in the presence of pain symptoms. *Psychiatria Danubina, 22*(1), 4-13.

Morone, N. E., Greco, C. M., & Weiner, D. K. (2008). Mindfulness meditation for the treatment of chronic low back pain in older adults: A randomized controlled pilot study. *Pain, 134*(3), 310–319. doi:10.1016/j.pain.2007.04.038

Müller, R., Gertz, K. J., Molton, I. R., Terrill, A. L., Bombardier, C. H., Ehde, D. M., & Jensen, M. P. (2016). Effects of a Tailored Positive Psychology Intervention on Well-Being and Pain in Individuals With Chronic Pain and a Physical Disability. *The Clinical Journal of Pain, 32*(1), 32–44. doi:10.1097/ajp.0000000000000225

Neff, K. D., & Germer, C. K. (2013). A Pilot Study and Randomized Controlled Trial of the Mindful Self- Compassion Program. *Journal of clinical psychology*, *69*(1), 28-44. doi:10.1002/jclp.21923

Ong, A. D., Zautra, A. J., & Reid, M. C. (2015). Chronic pain and the adaptive significance of positive emotions. *American Psychologist, 70*(3), 283–284. doi:10.1037/a0038816

Osman, A., Barrios, F. X., Kopper, B. A., Hauptmann, W., Jones, J., & O'neill, E. (1997). Factor structure, reliability, and validity of the Pain Catastrophizing Scale. *Journal of Behavioral Medicine*, *20*(6), 589-605. Doi: 10.1023/a:1025570508954

Parks, A. C., & Biswas-Diener, R. (2013). Positive interventions: Past, present and future. *Mindfulness, acceptance, and positive psychology: The seven foundations of well-being*, 140-165.

Perridge, D., Hefferon, K., Lomas, T., & Ivtzan, I. (2017). "I feel I can live every minute if I choose to": participants' experience of a positive mindfulness programme. *Qualitative Research in Psychology*, *14*(4), 482–504. doi:10.1080/14780887.2017.1359709

Peters, M. L., Smeets, E., Feijge, M., van Breukelen, G., Andersson, G., Buhrman, M., & Linton, S. J. (2017). Happy Despite Pain: A Randomized Controlled Trial of an 8-Week Internet-delivered Positive Psychology Intervention for Enhancing Well-being in Patients With Chronic Pain. *The Clinical Journal of Pain*, *33*(11), 962–975. http://doi.org/10.1097/AJP.0000000000000494

Peterson, C., & Seligman, M. E. (2006). The Values in Action (VIA) classification of strengths. *A life worth living: Contributions to positive psychology*, 29-48. https://doi.org/10.5860/choice.44-1815

Pradhan, E. K., Baumgarten, M., Langenberg, P., Handwerger, B., Gilpin, A. K., Magyari, T., … Berman, B. M. (2007). Effect of Mindfulness-Based stress reduction in rheumatoid arthritis patients. *Arthritis & Rheumatism, 57*(7), 1134–1142. doi:10.1002/art.23010

Price, C. (2012). National pain audit final report. *Health Quality Improvement Partnership*. Retrieved from http://www.nationalpainaudit.org/media/files/NationalPainAudit-2012.pdf

Rosenzweig, S., Greeson, J. M., Reibel, D. K., Green, J. S., Jasser, S. A., & Beasley, D. (2010). Mindfulness-based stress reduction for chronic pain conditions: Variations in treatment outcomes and role of home meditation practice. *Journal of Psychosomatic Research, 68,* 29–36. doi:10.1016/j.jpsychores.2009.03.010

Rybak, C. (2012). Nurturing Positive Mental Health: Mindfulness for Wellbeing in Counseling. *International Journal for the Advancement of Counselling*, *35*(2), 110–119. doi:10.1007/s10447-012-9171-7

Salim, A., Mackinnon, A., Christensen, H., & Griffiths, K. (2008). Comparison of data analysis strategies for intent-to-treat analysis in pre-test–post-test designs with

substantial dropout rates. *Psychiatry research*, *160*(3), 335-345. doi:10.1016/j.psychres.2007.08.005

Scheffel, B. (2003). *Loving-Kindness Meditation: Meditations to Help You Love Yourself, Love Others, and Create More Love and Peace in the World (Lovingkindness)* (p. 96). Fair Winds Press.

Schütze, R., Rees, C., Preece, M., & Schütze, M. (2010). Low mindfulness predicts pain catastrophizing in a fear-avoidance model of chronic pain. *Pain, 148*(1), 120–127. doi:10.1016/j.pain.2009.10.030

Seligman, M. (2011). *Flourish: a visionary new understanding of happiness and well-being*. New York: Free Press.

Seligman, M. E., Rashid, T., & Parks, A. C. (2006). Positive psychotherapy. *American psychologist*, *61*(8), 774-788. doi:10.1037/0003-066x.61.8.774

Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology*, *62*(3), 373–386. doi:10.1002/jclp.20237

Smyth, C. (2018, March 21). Back pain treatment is useless, experts warn. *The Times*. Retrieved from https://www.thetimes.co.uk/article/back-pain-treatment-is-useless-experts-warn-6xvrljcmp?shareToken=a764c1fd597314351e4939a03930ca30.

Sullivan, M. J. L., Bishop, S. R., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and validation. *Psychological Assessment, 7*(4), 524–532. doi:10.1037/1040-3590.7.4.524

Sullivan, M. J. L., Thorn, B., Haythornthwaite, J. A., Keefe, F., Martin, M., Bradley, L. A., & Lefebvre, J. C. (2001). Theoretical perspectives on the relation between catastrophizing and pain. *The Clinical Journal of Pain, 17*(1), 52–64. doi:10.1097/00002508-200103000-00008

Sun, J., Kaufman, S. B. and Smillie, L. D. (2018). Unique associations between big five personality aspects and multiple dimensions of well-being. *Journal of Personality*, *86*, 158-172. doi:10.1111/jopy.12301

Teasdale, J. D. (n.d.). Mindfulness-based cognitive therapy. *Cognition, Emotion and Psychopathology*, 270–289. doi:10.1017/cbo9780511521263.015

Thompson, L. B. (2014). *Living well with chronic pain: A classical grounded theory* (Doctoral dissertation). University of Canterbury, New Zealand.

Trompetter, H. R., Bohlmeijer, E. T., Veehof, M. M., & Schreurs, K. M. (2015). Internet-based guided self-help intervention for chronic pain based on Acceptance and Commitment Therapy: a randomized controlled trial. *Journal of Behavioral Medicine*, *38*(1), 66-80. doi:10.1007/s10865-014-9579-0

Turk, D. C., Wilson, H. D., & Cahana, A. (2011). Treatment of chronic non-cancer pain. *The Lancet, 377*, 2226–2235. doi:10.1016/S0140-6736(11)60402-9

Turner, J. A., Anderson, M. L., Balderson, B. H., Cook, A. J., Sherman, K. J., & Cherkin, D. C. (2016). Mindfulness-based stress reduction and cognitive behavioral therapy for chronic low back pain: similar effects on mindfulness, catastrophizing, self-efficacy, and acceptance in a randomized controlled trial. *Pain*, *157*(11), 2434-2444. doi:10.1097/j.pain.0000000000000635

Van Gordon, W., Shonin, E., & Griffiths, M. D. (2015). Meditation Awareness Training for Individuals with Fibromyalgia Syndrome: an Interpretative Phenomenological Analysis of Participants' Experiences. *Mindfulness*, *7*(2), 409–419. doi:10.1007/s12671-015-0458-8

Veehof, M. M., Oskam, M. J., Schreurs, K. M., & Bohlmeijer, E. T. (2011). Acceptance-based interventions for the treatment of chronic pain: a systematic review and meta-analysis. *Pain*, *152*(3), 533-542. https://doi.org/10.1016/j.pain.2010.11.002

Veehof, M. M., Trompetter, H. R., Bohlmeijer, E. T., & Schreurs, K. M. G. (2016). Acceptance- and mindfulness-based interventions for the treatment of chronic pain: a meta-analytic review. *Cognitive Behaviour Therapy*, *45*(1), 5–31. doi:10.1080/16506073.2015.1098724

Volkow, N., Benveniste, H., & McLellan, A. T. (2017). Use and Misuse of Opioids in Chronic Pain. *Annual review of medicine,* Vol. 69:451-465. https://doi.org/10.1146/annurev-med-011817-044739

Walach, H., Buchheld, N., Buttenmüller, V., Kleinknecht, N., & Schmidt, S. (2006). *Freiburg Mindfulness Inventory*. PsycTESTS Dataset. doi:10.1037/t04847-000

Ware, J. E. (2000). SF-36 Health Survey Update. *Spine*, *25*(24), 3130–3139. doi:10.1097/00007632-200012150-00008

White, I. R., Horton, N. J., Carpenter, J. & Pocock, S. J. (2011). Strategy for intention to treat analysis in randomised trials with missing outcome data. *The BMJ*, *342*, d40. http://doi.org/10.1136/bmj.d40

Zautra, A. J., Davis, M. C., Reich, J. W., Nicassario, P., Tennen, H., Finan, P., … Irwin, M. R. (2008). Comparison of cognitive behavioral and mindfulness meditation interventions on adaptation to rheumatoid arthritis for patients with and without history of recurrent depression. *Journal of Consulting and Clinical Psychology, 76*(3), 408–421. doi:10.1037/0022-006x.76.3.408

SECTION C: APPENDICES OF SUPPORTING MATERIAL

Abi Davison Jenkins

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April 2018

A thesis submitted in partial fulfilment of the requirements of Canterbury Christ Church University for the degree of Doctor of Clinical Psychology

Appendix A: Table of measures of wellbeing used by studies

Outcome measure	Lead author, year	Wellbeing facets measured[4]	Validity and reliability
Satisfaction with life scale (SWLS)	Diener (1985)	Life satisfaction (LE), positive affect (A)	Good internal consistency, moderate test-retest reliability. Well established construct validity. Predicts real world outcomes suggesting high criterion validity. (Pavot & Diener, 2008)
Mental Health Continuum-Short Form (MHC-SF)	Keyes (2002)	Emotional wellbeing (A), social wellbeing (E), psychological wellbeing (LE)	High internal and moderate test-retest reliability. The structure of 3 sub-factors was supported. (Lamers, Westerhof, Bohlmeijer, Klooster & Keyes, 2011)
Ryff Scales of Psychological Well-Being (SPWB)	Ryff (1989)	Autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, self-acceptance (all E)	Reliability **α**>0.8 and internal consistency **α** >0.85 for all subscales in original sample. More recent research has indicated fewer than 6 factors.
Depression, anxiety and positive outlook scale (DAPOS)	Pincus (2004)	Positive outlook (A)	Good internal consistency and construct validity (Pincus, Rusu & Santos, 2008).
Engaged living scale (ELS)	Trompetter (2013)	Valued living (E), life fulfillment (LE)	Good internal consistency and construct validity.
Positive and Negative Affect Schedule (PANAS)	Watson (1988)	Positive affect (A)	High reliability. Construct validity good. (Crawford & Henry, 2004)
Family relations likert scale	Davis (2013)	Positive relationships (E)	Not tested
VAS/ NRS of global wellbeing	Kaplan (1993), Zangi (2011)	Subjective wellbeing (LE)	Not tested
Patient Global Impression of Change scale (modified, PGIC)	Dowd (2015)	Change in Ability to manage emotions (A), Dealing with stressful	Good reliability. Validity not tested.

[4] LE = life evaluation; A = positive affect; E = eudaimonia

		situations (E), Ability to enjoy pleasant events (A)	
Quality of life inventory (QOLI)	Frisch (1992)	Life satisfaction in areas of: Health, Self-Esteem, Goals-and-Values, Money, Work, Play, Learning, Creativity, Helping, Love, Friends, Children, Relatives, Home, Neighborhood, Community (LE)	Adequate internal consistency and test-retest reliability. Validated against 7 subjective wellbeing measures.
The Quality of Life Profile for the Chronically Ill (QoL)	Siegrist (1996)	General functional capacity (E); ability to derive joy and to relax (A); positive affect (A); ability to maintain and develop social contacts (E); sense of social connectedness (E)	Validated (Laubach, Schröder, Siegrist & Brähler, 2001)
Short-form (SF-36)	Ware (2000)	Vitality (A), mental health (A)	Reliability and validity tested in various studies, mostly acceptable levels (see Ware, 2000)
Likert scale "*How do you experience your general quality of life today compared with the time before the intervention?*"	Kold (2012, 2015)	Quality of life (LE)	Not tested

Appendix B: Baseline characteristics of completers

Baseline characteristics	All (n = 30)	MBF (n = 16)	Waitlist (n = 14)
Age M (SD)	47.23 (15.66)	49.94 (14.85)	44.14 (16.52)
Gender			
Male	10	6	4
Female	20	10	10
Education			
School	3	2	1
College	7	3	4
Undergraduate	10	5	5
Postgraduate	10	6	4
Main source of pain			
Back pain	6	3	3
Fibromyalgia	3	2	1
Arthritis	4	2	2
Chronic widespread pain	5	1	4
Headache	4	3	1
Neuropathic pain	3	3	0
Other	5	3	2
Duration of pain			
3 - 12 months	2	1	1
13 months - 2 years	6	4	2
2 to 5 years	9	3	6
> 5 years	13	8	5
Meditated regularly in past (weekly for > 6m)			
Yes	1	0	1
No	29	16	13

Appendix C: Recruitment flyer

You are invited to take part in a 4-week online mindfulness program. This program involves meditation and exercises from Positive Psychology, which aim to increase wellbeing. Each module will begin with a short video introducing you to an aspect of mindfulness and Positive Psychology. You will then be invited to do a daily meditation and an exercise that focuses on an aspect of wellbeing. The topics covered include: self-awareness, positive emotions, self-compassion, autonomy, self-efficacy, meaning, relationships and engagement.

Mindfulness is a way of paying attention to the present moment, in a non-judgmental, accepting and curious manner. It can be developed through meditation and other activities.

Positive Psychology is the scientific study of happiness and wellbeing. It looks at what makes us flourish.

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A research study

Investigating the impact of a positive mindfulness program on well-being in people with chronic pain

SIGN ME UP

I'm interested! What next?

Contact me, Abi Jenkins, **by email at ad498@canterbury.ac.uk** stating that you would like to register for the Positive Mindfulness Program research study. You can also contact me for more information if you think you might be interested but are not sure and would like more information.

I look forward to hearing from you!

To do the Positive Mindfulness Program you must:

Participation is not mandatory and will not affect your existing care arrangements.

Practicing mindfulness has been demonstrated to have a variety of benefits such as reducing stress, depression, anxiety, insomnia and pain symptoms. Positive psychology interventions have been shown to increase wellbeing by enhancing resilience, improving health and having a positive impact on relationships.

The Positive Mindfulness Program is the first of its kind to combine aspects of positive psychology and mindfulness into an online course specifically designed to enhance wellbeing. Previous participants who have taken the program have experienced reduced depression and stress, and increased wellbeing. The participants who gained the most were those who finished the whole programme and did the activities on a daily basis.

You may become more aware of your emotions, good or bad, because the program involves paying attention to yourself. The program will be enjoyable for most people, but if you have any concerns you may contact the researcher whose details are on this leaflet, your pain clinician or your GP.

Appendix D: Participant information sheet

Information about the research

An investigation into the impact of an online Positive Mindfulness Programme on the wellbeing of people with chronic pain

Hello. My name is Abi and I am a trainee clinical psychologist at Salomon's Centre for Applied Psychology, which is part of Canterbury Christ Church University. I would like to invite you to take part in a research study. Before you decide it is important that you understand why the research is being done and what it would involve for you.

Talk to others about the study if you wish.

Part 1: *the purpose of this study and what will happen to you if you take part.*

What is the purpose of the study?
We are doing this study to investigate whether an online mindfulness course can help improve wellbeing in people who experience chronic pain. We know that being in pain can reduce people's quality of life and affect their happiness. We also know that chronic pain is very common, so it seems important to investigate interventions that might help people with chronic pain. The Positive Mindfulness Programme is aimed at improving wellbeing, so we thought it might be beneficial for people with chronic pain. In this study, the focus is on improving wellbeing rather than focusing on reducing symptoms. However, some studies suggest that mindfulness may help to reduce pain, so we are also interested in seeing whether people experience less pain as a result of participating in the programme.

Why have I been invited?
The INPUT unit at St Thomas's Hospital and the Pain Management Centre at Churchill Hospital have agreed to take part in this research. The participants in the study will be 50 people who have come to see a clinician at one of these two units.

Do I have to take part?
It is up to you to decide if you want to join the study. Your decision will not affect the treatment that you receive from the pain unit. If you agree to take part, I will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. Withdrawing would not affect the standard of care you receive.

What is the Positive Mindfulness Programme? *The programme involves meditation and exercises from Positive Psychology, which aim to increase wellbeing. There are 8 modules: self-awareness, positive emotions, self-compassion, autonomy, self-efficacy, meaning, relationships and engagement. Each module begins with a short video clip introducing you to one of the topics. Then, for the next 14 days, you will do a 10 minute daily meditation and exercise focusing on that topic. Every 14 days you will move on to a new module.*

What will happen to me if I take part?
If you decide you would like to participate in the Positive Mindfulness Programme, I will email you with a link to five questionnaires to complete. These will take you around 10 minutes in total. You will be asked to complete these questionnaires on three occasions: as soon as you enter the study, after 4 weeks and then finally after 8 weeks.

Randomised Trial: *In order to find out whether the Positive Mindfulness Programme is helpful for people with chronic pain, we need to compare people who have completed the programme with people who have not yet completed it. To do this, we will randomly allocate each person to either receive the programme straight away (Group A) or to wait for eight weeks before receiving it (Group B). This way, everyone who decides to take part in this study will get access to the Positive Mindfulness Programme.*

If you are in Group A, you will also be asked to do the Positive Mindfulness Programme for the first four weeks. If you are in Group B you will be given access to the Positive Mindfulness Programme after 8 weeks, once you have completed the questionnaires for the third time. *The flow chart overleaf shows this process.*

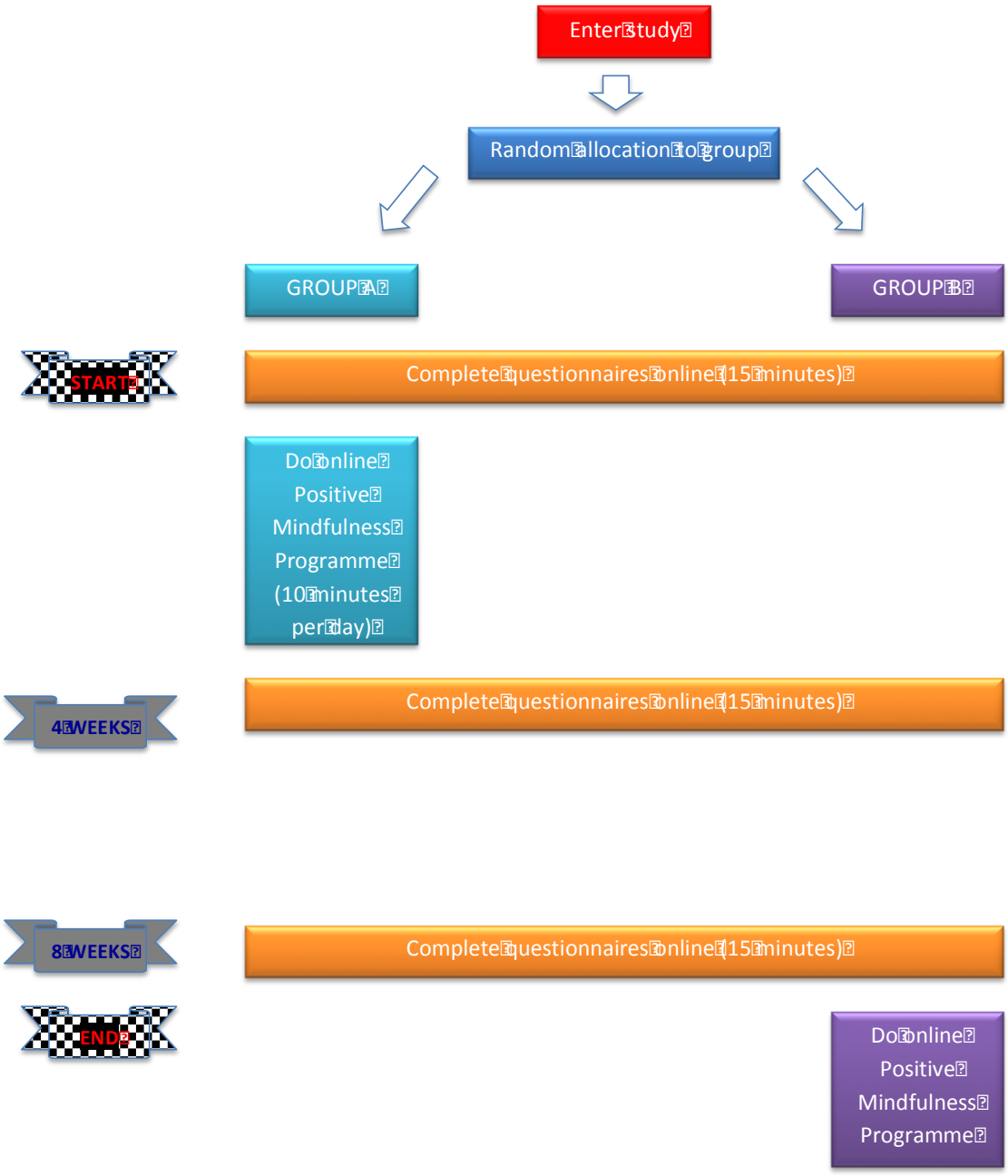
Prize draw!
There will be a prize draw at the end of the study (in Spring 2018) where two people who have taken part in the study will each win £50 of vouchers.

What are the possible disadvantages and risks of taking part?
You may become more aware of your emotions, good or bad, because the Positive Mindfulness Programme involves paying attention to yourself. The Positive Mindfulness Programme will be enjoyable for most people, but if you have any concerns you may contact your clinician, your GP, or me.

What are the possible benefits of taking part?
Practicing mindfulness has been demonstrated to have a variety of benefits such as reducing stress, depression, anxiety, insomnia and pain symptoms. Positive psychology interventions have been shown to increase wellbeing by enhancing resilience, improving health and having a positive impact on relationships.
The Positive Mindfulness Programme (PMP) is the first of its kind to combine aspects of positive psychology and mindfulness into an online course specifically designed to enhance wellbeing. Previous participants who have taken the PMP have experienced reduced depression and stress and increased wellbeing. The participants who gained the most were those who finished the whole programme and did the activities on a daily basis.

We cannot promise the study will help you but the information we get from this study will help us to understand whether the Positive Mindfulness Programme could be used in the treatment of people with chronic pain.

Flow chart of participation in the study



This completes part 1.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2 of the information sheet

What will happen if I don't want to carry on with the study?
You may withdraw from the study at any time and you do not have to give a reason. If you do withdraw from the study, we would like to use the data collected up to your withdrawal. This data will remain anonymous.

What if there is a problem?
If you have a concern about any aspect of this study, you should email me at ad498@canterbury.ac.uk or call 0333 0117073 and ask to speak to me. I will do my best to address your concerns. If you remain unhappy and wish to complain formally, you can do this by contacting Professor Paul Camic, Research Director, Salomons Centre for Applied Psychology – paul.camic@canterbury.ac.uk, tel: 03330117114.

Will information from or about me be kept confidential?
All data will be gathered anonymously. You will be asked to register with an anonymous username of your choice and I encourage you to use something that does not reveal your identity. The data I collect will be stored securely in electronic form and will only be accessible to the study researchers. This data will be kept by Salomon's Centre for Applied Psychology following the study but will remain anonymous and confidential, and stored in a locked cabinet.

I will need your email address in order to email the links for the questionnaires and online programme to you. This will be stored on an encrypted, password-protected, private computer and deleted at the end of the study.

What will happen to the results of the research study?
Once the study is finished I will write a short report that I will send to your pain clinic and, if you wish, email directly to you. The research will also be written up for my doctoral thesis. This will be printed and kept in the library at Salomon's Centre for Applied Psychology. It may also be accepted for publication in a journal. No participant will be identifiable in any of these reports.

Who is organising and funding the research?
Canterbury Christ Church University.

Who has reviewed the study?
All research in the NHS is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by the Research Ethics Committee South West – Cornwall & Plymouth.

Further information and contact details
If you would like to speak to me and find out more about the study or have questions about it answered, you can leave a message for me on a 24-hour voicemail phone line at 03330 117070. Please say that the message is for me, Abi Jenkins, and leave a contact number so that I can get back to you. If you would like advice on whether or not to participate you could talk to your consultant or another healthcare professional in the pain unit.

Appendix E: Consent form

The below consent form was completed by participants online before proceeding to the online questionnaires.

Please read each statement below and tick to confirm you if you agree. Ticking all boxes confirms your consent to participate in the research.

If you have any questions or concerns, please contact the researcher at ad498@canterbury.ac.uk

- ☐ I confirm that I have read and understand the Information for the Positive Mindfulness study and have had the opportunity to ask questions.
- ☐ I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.
- ☐ I understand that my decision to take part, or not, in the study will not affect the treatment that I receive from the pain unit.
- ☐ I understand that my data will be kept anonymous.
- ☐ I agree to take part in the above study.

Appendix F: Original confirmation of ethical approval from REC

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Appendix G: Confirmation of approval of substantial amendment

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Appendix H: Email correspondence with REC to confirm additional site

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Appendix I: HRA approval email

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Appendix J: Confirmation of approval of further substantial amendment

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Appendix K: R&D approval

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Appendix L: Correlations within measures over time

Table 1

Mindfulness (FMI) correlations

		Freiburg Mindfulness Inventory total score	FMI_total_T2	FMI_total_T3
Freiburg Mindfulness Inventory total score	Pearson Correlation	1	.747**	.648**
	Sig. (2-tailed)		.000	.000
	N	30	30	30
FMI_total_T2	Pearson Correlation	.747**	1	.840**
	Sig. (2-tailed)	.000		.000
	N	30	30	30
FMI_total_T3	Pearson Correlation	.648**	.840**	1
	Sig. (2-tailed)	.000	.000	
	N	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2

Subjective wellbeing (PERMA) correlations

		PERMA_overall_T1	PERMA_overall_T2	PERMA_overall_T3
PERMA_overall_T1	Pearson Correlation	1	.810**	.804**
	Sig. (2-tailed)		.000	.000
	N	30	30	30
PERMA_overall_T2	Pearson Correlation	.810**	1	.897**
	Sig. (2-tailed)	.000		.000
	N	30	30	30
PERMA_overall_T3	Pearson Correlation	.804**	.897**	1
	Sig. (2-tailed)	.000	.000	
	N	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3

Pain catastrophising (PCS) correlations

		Pain Catastrophising total score	PCS_total_T2	PCS_total_T3
Pain Catastrophising total score	Pearson Correlation	1	.846**	.771**
	Sig. (2-tailed)		.000	.000
	N	30	30	30
PCS_total_T2	Pearson Correlation	.846**	1	.798**
	Sig. (2-tailed)	.000		.000
	N	30	30	30
PCS_total_T3	Pearson Correlation	.771**	.798**	1
	Sig. (2-tailed)	.000	.000	
	N	30	30	30

Table 4

Symptom severity (SSS) correlations

		Symptom Severity Score total	SSS_total_T2	SSS_total_T3
Symptom Severity Score total	Pearson Correlation	1	.860**	.880**
	Sig. (2-tailed)		.000	.000
	N	30	30	30
SSS_total_T2	Pearson Correlation	.860**	1	.919**
	Sig. (2-tailed)	.000		.000
	N	30	30	30
SSS_total_T3	Pearson Correlation	.880**	.919**	1
	Sig. (2-tailed)	.000	.000	
	N	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5

Widespread pain (WPI) correlations

		Widespread Pain Index total score	WPI_total_T2	WPI_total_T3
Widespread Pain Index total score	Pearson Correlation	1	.927**	.849**
	Sig. (2-tailed)		.000	.000
	N	30	30	30
WPI_total_T2	Pearson Correlation	.927**	1	.916**
	Sig. (2-tailed)	.000		.000
	N	30	30	30
WPI_total_T3	Pearson Correlation	.849**	.916**	1
	Sig. (2-tailed)	.000	.000	
	N	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6

Health quality of life (EQ-5D-5L) correlations

		EQ_mean_T1	EQ_mean_T2	EQ_mean_T3
EQ_mean_T1	Pearson Correlation	1	.824**	.848**
	Sig. (2-tailed)		.000	.000
	N	30	30	30
EQ_mean_T2	Pearson Correlation	.824**	1	.869**
	Sig. (2-tailed)	.000		.000
	N	30	30	30
EQ_mean_T3	Pearson Correlation	.848**	.869**	1
	Sig. (2-tailed)	.000	.000	
	N	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Table 7

Health today (VAS) correlations

		Health today VAS	Health today VAS	Health today VAS
Health today VAS	Pearson Correlation	1	.742**	.846**
	Sig. (2-tailed)		.000	.000
	N	30	30	30
Health today VAS	Pearson Correlation	.742**	1	.719**
	Sig. (2-tailed)	.000		.000
	N	30	30	30
Health today VAS	Pearson Correlation	.846**	.719**	1
	Sig. (2-tailed)	.000	.000	
	N	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix M: T-tests for baseline outcome measure differences between the Complete Case (CC) sample and cases excluded due to missing data

Measure at baseline	Excluded group (n=18) Mean (standard deviation)	CC group (n=30) Mean (standard deviation)	T (significance)
FMI	29.39 (7.62)	31.13 (6.87)	0.83 (0.41)
PCS	24.89 (11.15)	23.83 (13.24)	0.28 (0.79)
WPI	6.17 (3.54)	6.47 (4.76)	0.17 (0.82)
SSS	8.06 (2.44)	6.93 (2.80)	0.39 (0.17)
PERMA	4.95 (1.84)	5.20 (1.41)	0.54 (0.56)
EQ-5D-5L	2.97 (0.63)	2.31 (0.60)	3.58* (0.001)
Health today	48.00 (20.69)	55.80 (17.15)	1.41 (0.17)

* significant at the < 0.01 level

Appendix N: T-tests for differences between intervention group and control at baseline

Table 1

T-tests for differences between intervention group and control at baseline (whole sample, n=48)

Measure at baseline	Intervention group (n=29) Mean (standard deviation)	Control group (n=19) Mean (standard deviation)	T (significance)
FMI	31.59 (7.43)	28.79 (6.07)	1.37 (0.18)
PCS	23.62 (11.79)	25.16 (13.52)	0.42 (0.68)
WPI	6.93 (4.26)	5.47 (4.34)	1.15 (0.26)
SSS	7.41 (2.44)	7.26 (3.12)	0.19 (0.85)
PERMA	5.07 (1.58)	5.17 (1.60)	0.20 (0.84)
EQ-5D-5L	2.67 (0.69)	2.39 (0.66)	1.40 (0.17)
Health today	52.69 (19.22)	53.16 (18.48)	0.084 (0.93)

Table 2

T-tests for differences between CC intervention and control groups at baseline (CC, n=30)

Measure at baseline	Intervention group (n=16) Mean (standard deviation)	Control group (n=14) Mean (standard deviation)	T (significance)
FMI	33.00 (7.25)	29.00 (5.96)	1.63 (0.11)
PCS	22.06 (13.23)	25.85 (13.43)	0.79 (0.44)
WPI	6.75 (4.84)	6.14 (4.83)	0.34 (0.73)
SSS	6.50 (2.36)	7.42 (3.25)	0.90 (0.38)
PERMA	5.57 (1.31)	4.77 (1.46)	1.58 (0.12)
EQ-5D-5L	2.28 (0.59)	2.36 (0.63)	0.37 (0.72)
Health today	60.06 (17.83)	50.93(15.54)	1.49 (0.15)

Appendix O: Journal submission guidelines

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Appendix P: Summary letter of results to participants

The below letter is a draft that will be sent out to participants following review by the exam board.

Dear Participant,

Thank you very much for taking part in the positive mindfulness research study. I am writing to you because the study is now complete and I thought you might like to hear about what we found.

Aim of the study

We know that chronic pain can get in the way of doing the things that you want to do and can impact on quality of life and psychological wellbeing. We therefore wanted to try out the positive mindfulness programme (PMP), which aims to improve wellbeing, to see if it works.

What we did

In order to find out whether the Positive Mindfulness Programme was helpful for people with chronic pain, we randomly allocated people to either receive the programme straight away (Group A) or to wait for eight weeks before receiving it (Group B). We asked everyone to complete questionnaires three times over eight weeks. We then analysed the questionnaires to see whether the measurements changed over the eight weeks, and whether these changes differed between Group A and Group B.

What we measured

The questionnaires that you completed covered five main areas. These were:

- **Mindfulness:** the ability to be aware of, and accept non-judgementally, feelings, thoughts and sensations in the present moment.
- **Subjective wellbeing:** the tendency to feel positive emotions, to be absorbed and interested in activities, to have positive relationships, to have a sense of purpose and a sense of achievement.
- **Pain catastrophising:** the tendency to ruminate or dwell on the experience of pain, to magnify the threat from pain, and to feel helpless in the face of it.
- **Widespread pain and symptom severity:** the extent of pain and severity of associated symptoms.
- **Health quality of life:** the extent of problems in the areas of mobility, self-care, usual activities, pain/discomfort and anxiety/depression, and a rating of current health.

What we found

We found that the PMP improved participants' subjective wellbeing. That is to say, people who had done the PMP (Group A) generally reported a higher level of subjective wellbeing after taking the course. The PMP also improved Group A's health quality of life.

We also found that the PMP improved Group A's levels of mindfulness and reduced pain catastrophising.

The PMP itself did not reduce people's pain or symptom severity. This is what we expected; it is often the case that mindfulness programs improve psychological wellbeing and people's relationship with pain, without necessarily reducing the pain itself. However, interestingly, we saw a general reduction in participants' symptom severity over the course of the study, regardless of whether they received the PMP or not.

What next?

This was a small study, so we have recommended that more studies like it are done to see whether they also find that the PMP helps people with chronic pain to increase their wellbeing. If they do, there would be good evidence for suggesting that online positive mindfulness courses like the PMP are made available to patients suffering with chronic pain.

Appendix Q: Letter to ethics of provisional results

Date: 10th April 2018
REC reference number:
IRAS number:
Study Title:

Dear [chair of REC/R&D manager],

I am writing to inform you of the provisional initial results from the above research project. The research has been conducted as specified in the approved ethics applications. As recruitment was slow and attrition was high, the study so far is underpowered. Therefore recruitment is planned to continue until August 2018, for which ethical approval has been submitted.

Summary of research

Background: Chronic pain is a common complaint among adults and is associated with reduced quality of life and subjective wellbeing. Medical and pharmaceutical interventions have had limited success at reducing pain and therefore it is important to find ways of helping people live well despite pain. Psychological approaches to managing chronic pain have typically focused on symptom reduction, but some evidence suggests that mindfulness interventions for pain can also improve subjective wellbeing. We hypothesised that providing an intervention that explicitly focused on wellbeing may enhance participant gains.

Objectives: This study aimed to test the impact of an internet-delivered Mindfulness-Based Flourishing program (MBF), which combines mindfulness with positive psychology theory and interventions, on subjective wellbeing in a sample of adults with chronic pain.

Materials and methods: Fifty-seven adults who experienced chronic pain were randomly assigned to either the MBF or to a waitlist control condition. Outcome measures were taken via an online survey before and after the four-week intervention, and after a further four weeks. A complete case analysis approach was used, which included 30 of the original sample.

Results: The MBF led to increases in subjective wellbeing and mindfulness that reached significance by follow-up, and increased health quality of life at both time points compared to controls. Effect sizes were medium to large. A reduction in pain catastrophising was also seen in the MBF group over time. Widespread pain and symptom severity did not change significantly compared to controls. Significant correlations were observed between subjective wellbeing, health quality of life and all other variables at baseline.

Discussion: Despite being underpowered, the study showed promise for the MBF to be used as an intervention for improving wellbeing in chronic pain. The effect sizes for wellbeing improved on previous symptom reduction focused interventions.

Replication is necessary to strengthen the evidence, and future studies could investigate the mechanisms of change.

Arrangements for publication and dissemination

The findings are being submitted in the form of a thesis to Canterbury Christ Church University for the part fulfilment of my doctorate in Clinical Psychology. Following feedback from the examiners, the intention is for a paper detailing the research to be submitted to the Clinical Journal of Pain.

A summary of findings has been prepared and will be emailed to all participants, again following review by the examiners.

Yours sincerely,

Abi Davison Jenkins
Trainee Clinical Psychologist